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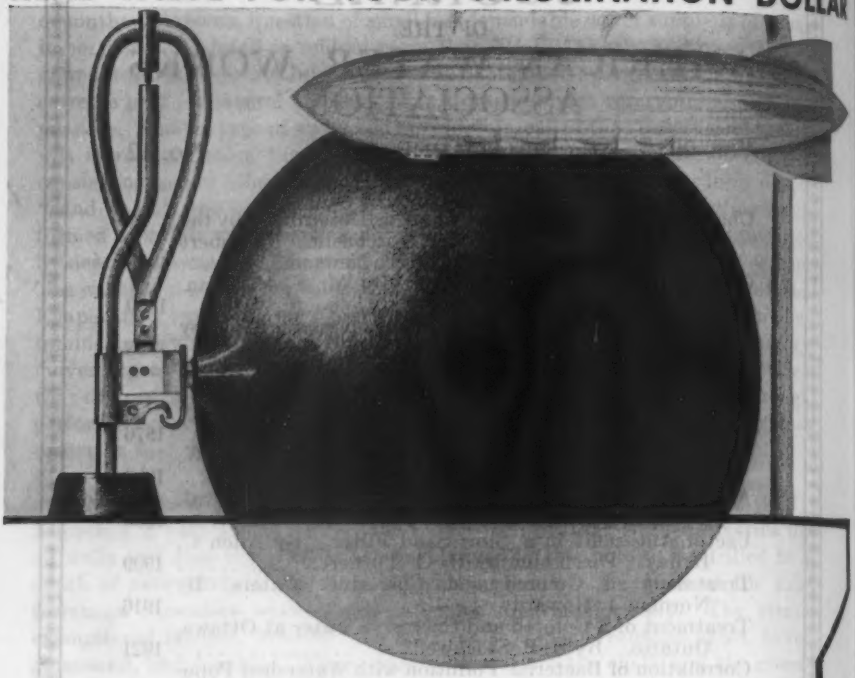

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Vol. 29 DECEMBER, 1937 No. 12

CHARGES FOR FIRE PROTECTION SERVICE AS DETERMINED BY THE PUBLIC SERVICE COMMISSION OF WISCONSIN*

BY ROBERT NIXON

(*Commissioner, Public Service Commission, Madison*)

It is generally recognized that water utilities furnish two major classes of service: water for general use in homes, stores, and shops; and fire protection service. Because the same property is jointly used to furnish these two major services, the task of dividing the total cost of service between these two major uses has always been a perplexing one. The difficulties are enhanced rather than lessened by the fact that general water service is furnished to a multitude of distinct users whereas fire protection service is furnished to owners of property through the medium of the municipality, acting in its governmental capacity and operating special fire-fighting facilities.

For nearly thirty years the Public Service Commission of Wisconsin (as well as its predecessor, the Railroad Commission) has wrestled with the problem of determining what is a fair and reasonable charge for fire protection service furnished by a water utility to a municipality. From this experience has come the conviction that the best answer to the question lies in developing a method of determining such charges in each community rather than the prescription of more

* Presented at the Wisconsin Section meeting, November, 1937.

or less standard rate schedules such as are applied to other classes of service. I propose therefore to outline in this paper some of the considerations entering into the method customarily used by the Commission, leaving to an appendix the application of this method to an actual case.

It appears advisable first to define what is meant by fire protection service. As we understand it, this service classification embraces what a water utility furnishes a city and its property owners by having a reliable source of water supply, pumping equipment, storage facilities, transmission and distribution mains, with hydrants attached thereto, adequate to supply the fire-fighting apparatus of the city with all the water it requires at any time even under conditions of maximum draught or demand by general service customers. Keeping ready to supply water under adequate pressure is a more important feature in this service than the actual amount of water used. Essentially, therefore, the charge for fire protection service is primarily a stand-by or readiness-to-serve charge. The charge should be sufficient to cover what are primarily capacity costs, rather than costs of the water itself. Consequently a rate for fire protection service cannot be expressed as so much per thousand gallons of water used in fighting fires. While it might be possible to quote such a rate as so much per unit of capacity, for example, gallons per minute, it has become the general practice to state the charge as a certain number of dollars per year, with provision for adjusting this charge as mains, with hydrants connected, are extended.

Nevertheless the charge is often referred to as a "hydrant rental." We believe this is a misnomer and is misleading. The hydrant is only the opening through which water is taken in the event a fire occurs. Obviously we do not have a fire protection system which consists only of hydrants. For example, in Muscle Shoals City near Wilson Dam real estate promoters years ago laid out streets and sidewalks and placed hydrants and street-light standards sufficient for a fair-sized city but the hydrants were not connected to any mains and the street-light standards were not connected to any feeders. Under such circumstances it is plain that the installation of hydrants alone hardly constituted the beginning of a fire protection system. In case of fire the hydrants would be useless without water-filled mains with adequate pressure for a fire stream. It seems to us that the term "hydrant rental" tends to obscure the fact that a fair charge for fire protection service is not based on the number of hydrants but on the

investment in property which can reasonably be assigned to the service and a fair share of the operating and maintenance costs. Also the comparison of fire protection charges on a "per hydrant" basis in many instances does not take into account the spacing between hydrants and the area covered by the fire protection system.

Most water works throughout the United States have been designed and constructed to furnish both fire protection and general water service. In Wisconsin, however, we have had several plants which were originally built to give only fire protection service. After some years of operation practically all these fire protection systems have been expanded to supply general service as well.

This is mentioned because of a tendency on the part of some people to adopt a theory that general water service should be considered as of more importance than fire protection service and that therefore charges for fire protection service should be determined upon what is called an additional cost or additional business basis. The Commission has not taken this view. From the various analyses of the investment and operating costs of water utilities and especially from reports of the National Board of Fire Underwriters, it appears that there would be just as much, if not more, reason and justice in doing exactly the opposite, namely, treating general service on the additional cost basis. As a matter of fact, however, the method developed by the Commission over a long period of years has been based upon the idea of dividing the joint investment and joint costs of water service on some fair and equitable basis.

The method used by the Commission can be briefly described as a cost analysis. This analysis can be broken down into steps described as follows: First, a separation of the used and useful property which can be said to have been built or installed for the purpose of being able to supply water at any time for fire protection service. Second, a determination of the maximum demands which each major class of service makes on the utility. Third, an estimate of the water used in fighting fires (usually a very small proportion of the total pumpage) plus a portion of the lost and unaccounted for water, since part of this is due to holding water in the system under pressure available for fire protection use. Fourth, a separation of the detailed operating expenses plus allowances for fixed charges such as depreciation, taxes, and interest or return between the major classes of service.

In making a separation of the portion of jointly used property assignable to fire protection service the first task is to cull out from

the used and useful property the investment in those items, such as meters and filtration plant equipment, which are wholly used in general service. Similarly, a separate listing should be made of the items of property wholly used for fire protection service, such as hydrants and their connections and fittings. What is left in the form of pumping equipment, reservoirs or standpipes and mains is jointly used property. In analyzing this jointly used property to arrive at a fair proportion assignable to fire protection service it is necessary to take the second step listed above, namely, determine the maximum demands which each major class of service makes on the utility. This is necessary because the bulk of the costs of fire protection service are in the nature of capacity costs.

As the Commission has pointed out in many of its opinions, it is generally conceded that the capacity of a water system should be nearly, if not fully, sufficient to meet the combined maximum demands of both fire protection service and general private service. In general, there will not, or should not, be any sewer flushing or street sprinkling at such a time, particularly in the smaller communities, where any unusual draft on the system might impair the fire service requirements. For the very large city this factor is not so important.

It is improbable but not impossible that in the smaller communities there may occur a combination of the maximum demands of fire protection service and general service. However, due to the improbability of the occurrence of a large fire during the hour of heavy domestic use of water, the capacity of the water system need not be fully equal to such emergency. An efficient management would, of course, shut off a part of the general service by temporarily closing, or partly closing, certain valves in the system if there was not sufficient capacity in the plant to meet the combined maximum demands of fire protection and general service. In the smaller water utilities it appears clear that if one division of the business should take precedence over the other for short, emergency periods, it is the fire protection service. It does not appear to be sound reasoning to say that because the pumps operate at the same rate irrespective of any fire demands that there is no investment in pumping equipment chargeable to this branch of the service.

One of the perplexing problems in determining a fair share of the investment in pumping equipment assignable to fire protection service

is the treatment of surplus pumping capacity. Similar difficulties are met in connection with surplus main capacity. In order to supply either fire protection or general service every water department must of necessity supply a certain surplus capacity of both equipment and mains at large expense in order to meet any emergency liable to arise at any time, day or night, as well as to provide for growth. If the water supply in the mains fails for a few hours, general consumers could still exist, but if it fails at time of fire, irremediable disaster and destruction of property might result. With these considerations in mind it seems only fair that the cost of providing reserve pumping capacity and mains should be shared between general water users and fire protection service.

In connection with the allocation of main capacity, it has been shown in many cases that for any given line of main piping on the outskirts of a distribution system the fire protection service furnished through it will, in general, call for much more water carrying capacity than will the private service supplied along the same line. Water for fighting a fire is taken from a single hydrant or a small group of hydrants near the fire. With this in mind it will be evident that those mains with hydrants attached which are most remote from the pumping stations must have large capacities as compared with the sizes of mains required in the same localities for the adequate service of general customers alone.

Making an estimate of the amount of water used in fighting fires plus a portion of the lost and unaccounted for water, which is the third step in our method of analysis, is useful in estimating the amount of output expense assignable to fire protection service. Once such figures are determined those who take a limited view of the service furnished by a water utility may be inclined to say that because such a small proportion of the water is used for putting out fires that therefore a small proportion of the total costs of service are assignable to fire protection. That this is a limited and erroneous view should be apparent from what I have said previously. Let me reiterate that fire protection service is largely a stand-by service, the costs of which are principally the costs of providing capacity and holding it in readiness to furnish water at any time a fire breaks out.

The fourth step in our method of analysis is to split the operating expenses, plus allowances for fixed charges, between the two major classes of service supplied. Here, as in the case of the analysis of

the property accounts, the initial step is to list first those expenses entirely associated with furnishing general service such as maintenance of meters and services, meter reading and collecting and, second, those expenses entirely associated with fire protection service such as hydrant inspection and maintenance. The remaining operating expenses are classifiable as joint and in our method of analysis are classified first between capacity expenses and output expenses on the basis of several factors as appropriate to each kind of expense (see Appendix). The capacity expenses are then split between fire protection and general service in the ratio of maximum fire demand to total demand on the system including fire demand. The output expenses are then split between the two major classes of service according to the estimated amount of water used, including losses, in the two services.

The fixed charges of depreciation, taxes, and interest are ordinarily split between general service and fire protection service on the basis of the division of the investment in physical property assigned to each class of service. This division of investment was determined in the first step of the analysis.

When all the costs of fire protection service derived from the foregoing analysis are totalled, they often amount to a sum in excess of what has previously been paid to the water department for this service. When this situation is met the Commission or a water utility has to deal with the problem of whether all these costs should be borne by the taxpayers through a charge to the municipality or whether some portion of the costs should be collected from the general users of water. This is a particularly acute problem in those communities where municipal budgets are so limited that the charging of the full costs of fire protection service constitutes one of the two or three major items in the budget.

It has been the position of the Commission that under ordinary circumstances the furnishing of fire protection creates an expense which should be borne by the taxpayers as distinguished from the general consumers. There are, of course, some exceptions to this principle. For example, take the case of a town operating a water system. A considerable part of the property in the town is beyond the fire protection limits of the water utility. In such a situation the charging of the full cost of fire protection service to the town would have the result of levying taxes against property owners outside the fire protection limits for a service from which they derive no benefit

whatsoever.* In such a situation adjustments have been made so that, as nearly as possible, only the taxable property benefited by the service is charged with the cost thereof.

The question is often raised also as to why a charge for the full cost of fire protection service should be made to a municipality when the property owners have previously been assessed for a portion of the cost of the property used in furnishing this service. As a general rule, municipal water utilities assess the property abutting on mains of 6 inches in size or less for the cost of those mains. The cost of mains in street intersections, however, and of the hydrants and stub mains leading to such hydrants, as well as the cost of mains exceeding 6 inches in size, is usually borne by the utility, financed either from surplus earnings or funds reserved for depreciation or in a few cases by the issuance of mortgage bonds by the utility.

Although this is the normal rule, there are some cases where mains up to 6 inches in size are assessed against the property owners and such assessment includes the cost of the hydrant, the stub main and valves. In such cases the taxpayers, of course, should not be required to pay a rate for fire protection service which includes an

* *Editor's Note:* Whether the use of the words "no benefit whatsoever" are precisely what the author intends to use is a question. Perhaps the words "no direct benefit" more closely approach his intended meaning. In other words the person who may live outside the limits of a municipal water distribution system, yet inside the corporate limits, does derive some benefit from water service even though it may not be available to him at a particular point. The simple fact that he lives within the corporate limits of the municipality means that he has some interest in its activities and would be damaged if the area served by the water mains was destroyed by a conflagration. This would be true even though his own residence or industry escaped the fire, unless he, his business and his associations had a fully negative relationship to the rest of the municipality.

Author's rejoinder: The statement in question relates to those localities which we have in Wisconsin where the smallest political subdivision, the township, operates a water utility in an unincorporated community located in and supplying only a very limited portion of the township. In the several utilities operated by townships it is no doubt true that residents therein who are remote from the limits of the water distribution system have some interest in the activities of these utilities. They have an interest in that they may be taxed for the support of a fire protection system which affords no protection to their property. The interest of such a taxpayer is antipathetic, and this negative interest would seem to outweigh the positive interest in avoiding a conflagration in the more thickly settled portion of the town. It was in this negative sense that the phrase "no benefit" was used.

interest charge on their own investment. To guard against this the Public Service Commission in the past has therefore deducted from the rate-base the so-called contributions in aid of construction or, in other words, special assessments.

In this connection we must also consider the fact that some of the water pipe assessments have been contributed by vacant property. These contributions are normally apportioned to determine the amount in aid of construction first to general service and second to fire protection service. If this is all that were done, taxpayers actually taking water service would benefit from having the contribution from vacant property deducted from the investment upon which they pay a return. So that the taxpayers who have paid water pipe assessments, but who are not actually taking water service, may receive the full benefit from their contribution, it may be equitable to treat all contributions or assessments on vacant property as applicable to fire protection service.

In some cases we also meet with the desire on the part of the city officials to keep fire protection charges at a minimum and to assign a portion of these costs to the general users on the theory that much of the property is occupied by tenants who, if this were not done, would not bear their fair share of the cost of the service from which they derive benefits. Such considerations plunge us into intricate questions which the taxation experts discuss under the caption of "the incidence of taxation." Since communities differ in this respect and since the Commission cannot be presumed to pass judgment on the reasonableness of the rentals charged by a landlord to a tenant, it has always seemed to us that this factor should receive negligible consideration in determining charges for fire protection service. In this connection, we should not overlook the fact that when certain duplicate, or reserve, or additional plant investments are made as a result of underwriters' requirements, it is the property owners, not the tenants, who stand to gain most from reduced insurance costs.

Finally, the Commission frequently meets the attitude that a municipality should be privileged to fix its charges for service to itself on any basis that local officials deem proper since the municipality is the owner of the property. Usually this contention is made to support a charge for fire protection service which is insufficient to cover all the costs of such service, including depreciation and interest. It should be pointed out, however, that if this practice is carried to an

extreme, general users of water will be required to defray costs of fire protection service provided the utility insists upon a full reasonable return on the total investment. While a municipality may be willing to forego a full return upon its investment in the water property, it has appeared to the Commission inequitable to forego the full return on one class of service like fire protection and ask for a full return or more on the other major classes of service. This practice appears particularly inequitable in those cases where a water utility has financed main extensions and hydrants in advance of real estate improvements out of funds of the utility without resorting to special assessments. In these circumstances the general users of water are asked to pay not only costs of their own service but a portion of the cost of fire protection service to vacant property, the owners of which derive advantage from the availability of fire protection facilities.

It is regrettable but unavoidable that the determination of fire protection charges often involves sharp conflicts of interest between city officials, taxpayers, and water users. Even Solomon, with his proverbial wisdom, might be hard pressed to find an amicable and reasonable solution of some of these problems. The Commission, without the talents of a Solomon, has hitched its wagon to the twin principles:

(1) Consider each case on its merits
(2) Determine fire protection costs by a method of analysis flexible enough to take into consideration peculiar local circumstances.

In brief, we believe that cost analyses, not mere rule-of-thumb guesses, are the best bases for fair fire protection charges.

For those who are interested in further details I invite your attention to the appendix to this paper in which you will find a more detailed statement of the methods of analysis used.

APPENDIX I

We repeat what has been reiterated many times before, namely: In apportioning the value of items it seems improbable, in certain cases, that any definite lines can be drawn, or results reached upon which all could be expected to agree, and the results must be determined by careful study and consideration and the exercise of judgment as to what is fair.

A fairly detailed statement of the apportionment of the fixed capital and operating expenses is presented here with the bases used.

Where figures are shown, they are approximate averages. This is done with the thought in mind that it would give those interested a chance for constructive criticism and to suggest, if possible, any improvements or refinements which might be followed in the future.

I. APPORTIONMENT OF FIXED CAPITAL

1. *Land, Buildings and Structures*

Source of Supply Land, Water Rights and Structures. These items might be apportioned on the basis of the maximum indicated fire stream demands for fire protection service to total demands, including fire demands. It will vary from about 10 percent for a large city to as much as 60 percent for a very small village.

Pumping Station Land and Buildings. These values might be apportioned on the basis of the estimated required capacities of pumps and equipment, which govern the proportion of buildings and hence the land on which built, allocatable to each class.

This has frequently been determined on the basis of the formulas for Freeman's curves, here reproduced for convenience. The use of these formulas is particularly helpful since in most instances the actual fire demand experienced is infrequent and irregular. The estimate of fire demand should be based on what demands could reasonably be expected for a city of the size in question.

Freeman's curves:

$$\text{Maximum No. fire streams} = \frac{\text{Population in thousands}}{5} + 10$$

$$\text{Minimum No. fire streams} = 1.7\sqrt{\text{Population in thousands}} + 0.03 \text{ Pop. in thousands.}$$

The indicated number of fire streams are multiplied by the rate of discharge of stream per minute to determine fire demand in gallons flow. The rate of discharge of stream per minute will normally vary between 175 to 250 gallons per minute depending on the size of nozzle and nozzle pressure.

Storage Land, Reservoir and Standpipe. These items together are of more importance to fire protection service in the smaller communities because more reliance is placed on these structures for pressure. Hence a part is usually allocated to fire protection service on the basis of at least the normal minimum demand of this class of service.

General Office Land and Structures. This should be allocated on an overhead basis.

2. *Purification Buildings and Equipment*

Allocated entirely to general service since fire protection does not need pure filtered water.

3. *Pumping Station Equipment*

This has been apportioned to fire protection service on the basis of the indicated required capacity of fire protection service.

4. *Transmission and Distribution Investment*

Mains. This can be apportioned on the basis of minimum fire demand of fire protection service.

Services and Consumers' Meters. Apportioned 100 percent to general service.

Hydrants. Apportioned 100 percent to fire protection service.

5. *General Equipment*

This should be apportioned on an overhead basis except for *Laboratory Equipment* which should be charged entirely to general service, and *Shop* and *Transportation Equipment* might be apportioned on the basis of minimum fire demand of fire protection service.

With the completion of our apportionment of fixed capital we find that of the total there has been allocated to fire protection service, from 11 to 60 percent depending on the size of the community and equipment installed. This figure is used in apportioning our cost of operating the utility to divide the fixed charges, such as depreciation, taxes and return on the investment, between general service and fire protection service.

It has been fairly well demonstrated that the larger the city the more dependence the city puts on the pumpers used by the fire department for supplying water under high pressure. The larger utilities do not attempt to increase the pressure on the mains when fires occur as do many of the smaller. In many of the latter communities a reservoir, steel tank or stand pipe is placed in an elevated position so as to give the required high static pressure required by the fire protection service. In the smaller communities duplication of equipment is primarily due to the underwriters' requirements and this helps swell the proportion chargeable to the fire protection service.

Although the fire department uses water only at infrequent and irregular intervals, it at times requires many thousands of gallons per minute in a small portion of a city block. Such demand may occur at any point within a very large territory. In a small city it may equal from forty to sixty per cent of the total demand made on the plant.

A large city invariably maintains a great many portable pumpers. In one large city, such equipment is maintained with an aggregate rated pumping capacity of 26,500 gallons per minute. These pump only from hydrants on the water department's mains.

6. *Determination of Maximum Demands of Each Major Class of Service*

An examination of the pumpage and consumption records will disclose the date of the maximum hourly total. The maximum hourly peak used in the analysis is determined at a rate of a number of gallons per minute. To this demand we add an estimated fire protection service demand in gallons per minute, for apportioning our total capacity or demand costs. The use of Freeman's curves may be helpful in determining the maximum number of fire streams for a city of the size in question.

It is not necessary at this time to discuss such facts as that the peak hourly rate for residential consumers will not coincide with that for commercial and industrial customers. We are concerned here only with the percentage of the demand costs allocatable to fire protection service.

II. APPORTIONMENT OF OPERATING EXPENSES BETWEEN CAPACITY OR DEMAND COSTS, OUTPUT COSTS AND DIRECT TO GENERAL SERVICE OR FIRE PROTECTION SERVICE

It should be remembered that with a larger utility a more detailed system of accounts and breakdown of operating expenses is available in preparing an allocation of costs. With a smaller water utility, it may be necessary to make an allocation of a total amount expended for one general class of expenses without the possibility of making a more detailed breakdown. The apportionment used would be more of a composite ratio considering the nature of the expenses included in the total.

1. *Source of Water Supply*

These expenses include labor and material in repairs to river and lake sources, springs, large open wells, shallow tubular wells, deep artesian wells, or whatever the source of supply might be. These expense items occur quite regularly and for about the same amounts in successive years, in order to keep the source of supply in good condition. Since these expenses are largely fixed and do not vary with the amount of water pumped, they are allocated 100 percent to "capacity." It should be kept in mind that the capacity or demand costs are later apportioned to fire protection service, on the basis of the demand which the type of service makes on the system.

2. *Pumping Expenses*

Labor and Superintendence. Ordinarily a superintendent, using the common understanding of the duties of such an officer, devotes the greater part of his time to overseeing and directing, and his labor in that respect would be quite independent of output, and hence the greater portion should be charged to "capacity." In a small plant, the so-called superintendent is in reality a laborer and not so exclusively a director of operation. In such case a large part of his time in the station would be influenced by and proportioned to the output. The number of hours of productive labor roughly approximates the number of hours the pumping plant is operated at full load. In some cases the labor could be apportioned upon a load or capacity factor basis. Under these circumstances it would appear that from 20 percent to 30 percent of superintendence should be apportioned to "output" and the balance to "capacity." The capacity factor ratio is the ratio of total annual pumpage to annual plant pumping capacity on a 24 hour basis.

The operation of the pumping station may also require labor in addition to that of the superintendent. While the duties of this labor concern the operation of the pumps, a large part of this may be non-productive when considered on a load or capacity factor basis. It requires a certain amount of help at the station whether a hundred thousand or a million gallons of water are being pumped per day, so that the item of pump labor has been apportioned in a ratio similar to superintendence. If a considerable part of the electric pumping equipment is automatic in operation, the portion of labor apportionable to output would tend to be smaller.

Fuel. If steam power pumping is used this should be apportioned to capacity and output using percentages based on the division of coal between that used in banking boilers and for standby service and that used for pumping operation.

Lubricants. Lubricants used at the station would depend almost entirely upon the operation of the various pieces of apparatus so that this item can be charged 100 percent to output.

Pumping Supplies and Expenses. Some of these miscellaneous expenses occur regularly and hence are more or less fixed while others are dependent on the operation of the equipment and are proportional to the rate at which the plant is run. These costs are usually allocated 50 percent to capacity.

Maintenance of Buildings. This includes maintenance to pumping station buildings, fixtures and grounds, and to pumping equipment within the building or on the grounds. Maintenance expense on pumping station buildings occurs irrespective of the fact that the plant may be operating or idle. It is more or less a fixed expense and can be charged entirely to "capacity."

Maintenance of Pumping Equipment. Maintenance of pumping equipment is of several types. Some maintenance is necessary to keep up appearance of equipment such as cleaning, polishing and painting. This is chargeable to "capacity." Wear and tear at or near no load or accidents to idle machinery necessitate some maintenance. This portion may be small and should be charged to "capacity." The largest portion of maintenance is necessary due to the regular operation of the equipment and is properly chargeable to output. Some of this maintenance will vary according to the output considering the size of load and change in load. Other maintenance will vary in proportion to the degree to which the equipment may be overloaded. This would depend on the number and type of pumping units available for operation.

For a smaller utility where the breakdown of maintenance expense is not available in its accounting classification, an apportionment of maintenance of pumping equipment of 65 per cent to "output" and 35 per cent to capacity appears reasonable.

Maintenance of Miscellaneous Pumping Equipment. These items cover repair expenditures on cranes, hoists, machine tools, safety appliances and other miscellaneous equipment. A 50-50 split between capacity and output expenses appears reasonable.

Power Purchased. It is considered by some that this should be

chargeable entirely to "output" since when pumps are idle no current will be used and hence no expense of this nature incurred. Such an apportionment is incorrect for the reason that the amount paid for energy is itself made up of "capacity" and "output" costs. If energy is purchased on a demand and energy charge type of rate, the demand charge portion should represent the portion chargeable to capacity. In many cases this charge will average about 25 per cent of the total bill.

3. *Purification Expense*

On the assumption that purification and treatment of water is necessary only for the supply of general service, it would appear that it should be charged directly in its entirety to general service, although under certain conditions a certain small portion may be assignable to fire protection service and output expense.

4. *Transmission and Distribution Expenses Superintendence and Labor*

Superintendence, salaries of office employees, labor, and salaries of shop foremen and undistributed labor are apportioned 60 per cent to 70 per cent to capacity and 40 to 30 per cent to output as a rule. These percentages are the result of observation of the character of the various jobs handled.[4]

Salaries of engineers, shop labor, labor and teaming, miscellaneous field expense, rental of motor vehicles and miscellaneous distribution supplies and expenses have been allocated on a 50–50 basis.

If the above segregation is not available for a smaller water utility, a composite of about 60 percent to 40 percent may be used.

Storage Reservoir and Standpipe Labor. Labor of patrolling, inspecting, and operating the distribution-storage facilities, including distribution reservoirs, tanks and standpipes, transportation expense appear to be as much capacity as output expenses, and hence a 50–50 split appears reasonable.

Maps and Records. Labor involved in the upkeep of maps and records of the transmission and distribution system is little affected by any output of water. The information is for record purposes and should be charged 100 percent to "capacity."

Maintenance of Storage Reservoir and Standpipe. The expense items in this account are quite independent of the quantity of water sold and are charged 100 percent to "capacity."

Fuel. If steam power pumping is used this should be apportioned to capacity and output using percentages based on the division of coal between that used in banking boilers and for standby service and that used for pumping operation.

Lubricants. Lubricants used at the station would depend almost entirely upon the operation of the various pieces of apparatus so that this item can be charged 100 percent to output.

Pumping Supplies and Expenses. Some of these miscellaneous expenses occur regularly and hence are more or less fixed while others are dependent on the operation of the equipment and are proportional to the rate at which the plant is run. These costs are usually allocated 50 percent to capacity.

Maintenance of Buildings. This includes maintenance to pumping station buildings, fixtures and grounds, and to pumping equipment within the building or on the grounds. Maintenance expense on pumping station buildings occurs irrespective of the fact that the plant may be operating or idle. It is more or less a fixed expense and can be charged entirely to "capacity."

Maintenance of Pumping Equipment. Maintenance of pumping equipment is of several types. Some maintenance is necessary to keep up appearance of equipment such as cleaning, polishing and painting. This is chargeable to "capacity." Wear and tear at or near no load or accidents to idle machinery necessitate some maintenance. This portion may be small and should be charged to "capacity." The largest portion of maintenance is necessary due to the regular operation of the equipment and is properly chargeable to output. Some of this maintenance will vary according to the output considering the size of load and change in load. Other maintenance will vary in proportion to the degree to which the equipment may be overloaded. This would depend on the number and type of pumping units available for operation.

For a smaller utility where the breakdown of maintenance expense is not available in its accounting classification, an apportionment of maintenance of pumping equipment of 65 per cent to "output" and 35 per cent to capacity appears reasonable.

Maintenance of Miscellaneous Pumping Equipment. These items cover repair expenditures on cranes, hoists, machine tools, safety appliances and other miscellaneous equipment. A 50-50 split between capacity and output expenses appears reasonable.

Power Purchased. It is considered by some that this should be

chargeable entirely to "output" since when pumps are idle no current will be used and hence no expense of this nature incurred. Such an apportionment is incorrect for the reason that the amount paid for energy is itself made up of "capacity" and "output" costs. If energy is purchased on a demand and energy charge type of rate, the demand charge portion should represent the portion chargeable to capacity. In many cases this charge will average about 25 per cent of the total bill.

3. *Purification Expense*

On the assumption that purification and treatment of water is necessary only for the supply of general service, it would appear that it should be charged directly in its entirety to general service, although under certain conditions a certain small portion may be assignable to fire protection service and output expense.

4. *Transmission and Distribution Expenses Superintendence and Labor*

Superintendence, salaries of office employees, labor, and salaries of shop foremen and undistributed labor are apportioned 60 per cent to 70 per cent to capacity and 40 to 30 per cent to output as a rule. These percentages are the result of observation of the character of the various jobs handled.[4]

Salaries of engineers, shop labor, labor and teaming, miscellaneous field expense, rental of motor vehicles and miscellaneous distribution supplies and expenses have been allocated on a 50–50 basis.

If the above segregation is not available for a smaller water utility, a composite of about 60 percent to 40 percent may be used.

Storage Reservoir and Standpipe Labor. Labor of patrolling, inspecting, and operating the distribution-storage facilities, including distribution reservoirs, tanks and standpipes, transportation expense appear to be as much capacity as output expenses, and hence a 50–50 split appears reasonable.

Maps and Records. Labor involved in the upkeep of maps and records of the transmission and distribution system is little affected by any output of water. The information is for record purposes and should be charged 100 percent to "capacity."

Maintenance of Storage Reservoir and Standpipe. The expense items in this account are quite independent of the quantity of water sold and are charged 100 percent to "capacity."

Maintenance of Distribution Main Piping and Specials, Valves and Valve Boxes. The maintenance must be carried out, even though the use of service is only nominal compared to the capacity of the equipment which must be provided to meet the maximum demand. It is sometimes urged that this expense should be charged wholly to output, or at least the greater portion should be so allocated. It appears, however, that a substantial portion is expense which is incurred independently of actually furnishing water. It is rather the expense incurred by the utility in holding its mains in readiness to furnish water at any time in any quantity. In many cases this expense has been apportioned 60 percent to capacity and 40 percent to output.

Distribution Expense Items Directly Apportioned to One Class or Another. Some distribution expense items are incurred directly on property such as services and meters which is used for the specific supply of water service to the individual customer. These should be borne directly by the consumer affected. Such items are as follows:

Inspecting and Testing Meters and Measur-Devices	100 percent to general
Removing and Resetting Meters and Measuring Devices	100 percent to general
Inspecting Customers' Installations	100 percent to general
Maintenance, Bldgs. and Fixtures	100 percent to capacity
Services	100 percent to general
Meters	100 percent to general
Hydrants	100 percent to fire

If a detailed breakdown of distribution labor and maintenance is available other items may be apportioned directly:

Labor and Expenses—Hydrant Inspection	100 percent to fire
Wages—turn on and off men	100 percent to general
Wages—emergency watchman	100 percent to capacity
water waste inspector	100 percent to general
Maintenance, Service Connections	100 percent to general
Branch Connections	100 percent to fire
Tools and Equipment	100 percent to output
Shop and Machinery & Equip	100 percent to output

5. *Commercial Expenses*

Expenses of handling applications for water service, meter reading, preparing bills, collecting, bookkeeping and new business are dis-

tinctly consumer expenses and should be borne directly by general service customers. Hence these costs are apportioned 100 percent to general service.

6. *General and Miscellaneous Expenses*

These expenses are in the nature of fixed or indirect expenses. It is contended by some that they should be charged entirely to "capacity" in that they do not vary with or are affected to any considerable degree by the output. On the other hand they are occasioned in supplying that output, hence "output" should bear its proportionate part. One of the principles in cost accounting is that each unit of product must bear its share of the indirect expenses. The product of a water utility is service rather than a commodity, and the unit is composed of several elements, both "capacity" and "output" costs. Hence, it is not equitable to assess the indirect expenses to any one of these two elements, but each must bear its proper share. If this were not done it would be found that the rate would be so high for some short-hour users as to be prohibitive, while some long-hour consumer would be receiving a rate altogether too low.

General, Undistributed and Miscellaneous expenses are chargeable to all departments and to make an equitable distribution of these expenses, they are apportioned on an overhead basis, or in the same ratio as the totals of operating expenses other than these expenses bear to each other. If sufficient detail is available some general and miscellaneous expense items can be segregated, charged directly to the department to which they refer, and allocated on the same basis as the expenses of that department. Examples of such items are boiler insurance to pumping expense, fire insurance to maintenance of respective buildings to which it relates, and unemployment insurance and pensions expense to the salaries and wages to which they refer.

7. *Apportionment of Total Cost of Operation Between the Two Major Classes of Service; Capacity or Demand expense*—Apportioned to fire protection service on basis of maximum fire demand.

Output Expense. From the quantity of water actually used in fighting fires as obtained from the water department and from such data as are available as to losses, etc., it appears that as a rule only about 2 percent of the output cost is a reasonable amount to allocate to fire protection service.

Direct costs are, of course, allocated 100 percent.

The allowances for local taxes, retirement expense and return on the earning value have been apportioned on the estimated division of the physical property assignable to each class of service, giving from 10 to 60 percent to fire protection service depending on the size of the utility and the factors noted herein.

When the foregoing allocations have been made we have the total cost of operating the utility broken down into the two major classes of service supplied by the utility.

Each analysis shows that following the indicated bases of apportionment we get a lump sum charge for fire protection service as of a certain date. Many appear to believe that this cost should be divided by the number of hydrants in use to get a cost per hydrant. If this was done we might get a charge of $41.00 per hydrant for example. However, if an additional block or even if several blocks of main are laid, and hydrants installed, to add $41.00 for each hydrant placed might be excessive.

The additional charge for fire protection service which arises when main extensions are laid and new hydrants installed thereon will depend on such factors as the cost of the extension and the number of hydrants installed. If a proposed extension is not such that the capacity of the plant would have to be increased in order to meet the demand, it would seem that the charge for additional fire protection service on this extension would not include any of the capacity expenses of the utility, as these have already been included in the rate for existing fire protection. The cost to the municipality, therefore, for fire protection on the proposed extension, should be made up of the amount of the interest, local taxes and depreciation on the portion of the investment allocatable to this class of service and the cost to the utility of pumping whatever additional water is required. This is negligible as practically the only additional pumpage, aside from what water may actually be used in time of fire, will be the amount of leakage and cost of keeping water in the main, even if none is used.

If a 6-inch main costs $1.76 per foot to lay and 33.3 percent of the investment in mains is allocatable to fire protection service and our allowance for taxes, depreciation and return approximates 9.5 percent we get fixed charges per lineal foot of 6-inch main laid of approximately 5.6¢. With a hydrant costing in place (including its stub) about $100.00 and with the same 9.5 percent for fixed charges we get an additional charge for each hydrant placed of $9.50. The laying of

1200 feet of main and the placing of three hydrants on this basis would add $67.20 additional charge on main footage and $28.50 per hydrant.

It should be noted that the addition of new pumps, source of supply and other units might so affect the portion of fixed capital allocatable to fire protection service as to necessitate reanalyzing the costs.

Given below is a calculation of an illustrative application of the foregoing method of analysis to a hypothetical case of a water utility with about 1100 customers.

(1) *Determination of Fire Demand*

Per Freeman's curves:

Maximum number fire streams $\dots\dots\dots\dots \frac{4.4}{5} + 10 = 10.88$

Minimum number fire streams $\dots\dots\dots\dots 1.7\sqrt{4.4} + 0.03(4.4) = 3.60$

Maximum Fire Demand

General Service Demand	1600 gal. per min.	42.2%
Fire Protection Demand 11 streams @ 200 G.P.M.	2200 gal. per min.	57.8%
	3800 gal. per min.	100.0%

Minimum Fire Demand

General Service Demand	1600 gal. per min.	66.7%
Fire Protection Demand 4 streams @ 200 G.P.M.	800 gal. per min.	33.3%
	2400 gal. per min.	100.0%

(2)

	Total Investment	Allocated to F.P.S.	
Land—Pumping Station	$2,200	$1,272	57.8% to F.P.S.
General Office	1,400*		Overhead basis
Ground Source of Supply	14,900	8,612	57.8% to F.P.S.
General Office Building	4,600*		Overhead basis
Pumping Station Building	5,200	3,006	57.8% to F.P.S.
Reservoir and Standpipe	24,900	8,292	33.3% to F.P.S.
Purification	1,800	0	All to General Service
Pumping Station Equipment	15,900	9,190	57.8% to F.P.S.
Distribution Mains	116,000	38,628	33.3% to F.P.S.
Services	10,500	0	All to General Service
Meters	8,700	0	All to General Service
Hydrants	7,400	7,400	100% to F.P.S.
General Equipment	1,500*		Overhead basis
Total	$215,000		
Total (Eliminating *)	207,500	76,400	36.8%

ILLUSTRATIVE ANALYSIS OF COSTS OF SUPPLYING WATER SERVICE*

Allocation of Operating Expenses

Operating Expenses	Annual Expense	Allocation of Expenses				
		Capacity Costs	Output Costs	Direct to General Service	Direct to Public F.P.S.	
Source of Water Supply	$250	$250				100% to capacity
Electric Power Pumping:						
Labor and Supt.	1035	776	$259			75% to capacity; 25% to output
Pumping Supplies and Expenses	155	77	78			50% to capacity; 50% to output
Maintenance	275	96	179			35% to capacity; 65% to output
Power Purchased	3465	866	2599			25% to capacity; 75% to output
Purification	45		45			100% to output
Transmission and Distribution:						
Superintendence	90	54	36			60% to capacity; 40% to output
Storage Reservoir and Standpipe Labor	10	5	5			50% to capacity; 50% to output
Maps and Records	35	35				100% to capacity
Inspecting and Testing Meters	120			$120		100% direct to general service
Removing and Resetting Meters	135			135		100% direct to general service
Inspecting Customers Installations	30			30		100% direct to general service
Mtc. Storage Reservoir and Standpipe	80	80				100% to capacity
Distribution Mains	395	237	158			60% to capacity; 40% to output
Services	330			330		100% direct to general service
Meters	310			310		100% direct to general service
Hydrants	245				$245	100% direct to Fire Protection Service
Commercial	935			935		100% direct to general service
Total	$7940	$2476	$3359	$1860	$245	Same as note (15)
General and Miscellaneous	1430	446	605	335	44	31.2%, 42.3%, 23.4%, and 3.1% to respective
Total Operating Expense	$9370	$2922	$3964	$2195	$289	classes of expense

Allocation to General and Public Fire Protection Service

Costs	Total Expense	General Service	Public F.P.S.	
"Capacity" Costs	$2922	$1233	$1689	(1) 42.2% to general; 57.8% to F.P.S.
"Output" Costs	3964	3885	79	2% to F.P.S.
Direct Expense	2484	2195	289	
Total Operating Expense	$9370	$7313	$2057	
Uncollectible Bills	100	100		
Fixed Charges:				
Depreciation	3225			
Taxes	3440			
Return	6630			
Total F.C.	$13295	$8402	$4893	(2) 63.2% to general; 36.8% to F.P.S.
Total Operating Costs	$22765	$15815	$6950	

* For an average city of about 4400 pop., 1130 customers; Book value of property and plant, $215,000; customer contribution $55,000; Depreciation Reserve $42,000.

Discussion by REEVES J. NEWSOM.[1]—Mr. Nixon's paper represents a valuable contribution on the question of proper charges for fire protection. In spite of the fact that no charge is made by the water departments of the majority of municipalities, it is recognized by most water works men that the policy of avoidance of this issue cannot continue indefinitely. It is so clearly unjustifiable to continue to charge general water users for a large part of the costs of fire protection that, with the completion at an early date of a manual of accounting for water works systems, it can be anticipated that, at increasingly frequent intervals, something will be done about making this situation more equitable. It is therefore timely that a paper setting forth in such a definite way methods for the proper determination of the costs should be placed before the members of the Association.

There are certain points brought out by the paper and the appendix thereto, with which the writer is not in complete agreement and he therefore suggests that further thought be given to the following.

Under the Apportionment of Fixed Assets, Source of Supply Land, Water Rights and Structures are allocated on the basis of the ratio of fire to total demand, resulting in as high as 60 percent being charged to fire protection in a small village. It seems to the writer that impounded storage, land on the surrounding watershed and water rights, even in a small village, are substantially all for the purposes of the general service. It is the large amounts of water used daily that deplete storage. It is generally the question of quality that requires the ownership of land for protection. A relatively small amount of water in storage of whatever nature would serve for fire purposes.

Again, under Apportionment of Operating Expenses, Source of Supply Expense is charged 100 percent to "capacity", which subsequently becomes, to a large extent, a fire protection charge. It would seem that such operation expenses should all be charged to general service. While it is true that such expenses occur regularly and are not a function of output, at the same time the amount would not be lessened if only general service was being furnished.

On the other hand, the charging of all purification investment to general service does not seem justified. If the mains of the system are to be used for the combined purposes of fire and general service and the latter can use only potable water, the fire service, if it is to benefit from not having to carry the costs of a separate system

[1] Consulting Engineer, New York, N. Y.

of pipes, should be charged with whatever excess size it makes necessary in the purification plant, so that the latter can furnish a sufficient quantity of potable water for both purposes. Mr. Nixon's plan recognizes this factor under purification operating expense, where it is noted that under certain conditions a small portion may be assignable to fire protection service and output expense.

In apportioning investment in transmission and distribution mains it should be noted that in a gravity system the transmission mains should be apportioned on the basis of maximum, rather than minimum, fire demands. Also in this connection, it would seem advisable to charge to general service all mains smaller than 4 inches in diameter and all lines of 4 inch longer than 500 ft., if fed from one end only, and longer than 1000 ft. if supported from both ends.

It seems inconsistent to divide shop and transportation investment on the ratio of fire to total demands and then charge the maintenance of such equipment to output, 98 percent of which finds its way into general service charges. It would be preferable to charge the investment entirely to general service.

The writer doubts the advisability of attempting to charge a different rate per hydrant on new extensions, but would prefer to recalculate the whole hydrant charge at more frequent intervals. As a matter of fact it is more difficult to justify a full charge for an added hydrant on mains already in existence than where it is necessary to lay pipes into new territory.

Having in mind the fact that relatively few municipalities make any interdepartmental charge for public fire service and the rates charged when such procedure is followed and further, that private companies are fortunate if they succeed in collecting 10 percent to 12 percent of their gross revenues for this class of service, it is interesting to note how far the charges produced by the application of the Wisconsin method are above those ordinarily charged on either a per hydrant or an inch-foot basis.

Taking the example in the appendix of Mr. Nixon's paper, there would probably be in the neighborhood of 70,000 ft. of mains with perhaps 55 hydrants. This would mean a rate of approximately $120 per hydrant on that basis. Allowing, say, $15 per hydrant for yearly maintenance and fixed charges, a rate of approximately 2¢ per inch-foot would result under that method of charging. Comparing these with the average hydrant charge of about $50 and the average inch-foot charge of from ¾¢ to 1¢, the difficulties involved in having proper fire protection charges adopted can be visualized.

COLLECTING DELINQUENT ACCOUNTS*

By M. F. Hoffman

(*Commercial Superintendent, Cincinnati Water Works*)

"Utopia". Webster defines "Utopia" as . . . "an ideally perfect realm or condition."

To a Water Works chief executive "Utopia" means no delinquent accounts. Is it possible to have a situation where all bills are paid by the due date; particularly in these days of progression out of the depression? There is no panacea which may produce the above enviable position, but it is the purpose of this paper to attempt to to illustrate the factors which make for a perfect collection system, which is a cardinal part of a flexible, economical and accurate modern consumers' billing plan. In order to demonstrate the possible procedure by which such results may be attained, no direct attempt will be made to compare one system with another, as each has its own advantages and disadvantages, in accordance with the various limitations and requirements of certain localities. It will be shown, however, what has been done in Cincinnati and other cities, and what the possibilities of such plan offer in other communities, with certain modifications to meet local conditions.

It is generally known that the ledger plan, whether the register sheet or the two-year ledger sheet, and the ledger card method have certain limitations. These sheets or cards are prepared at the same time as the bill, providing mechanical means are used, and payments, when made, are credited to either of these two control units. The resistance to the enforcement of the collection of delinquent accounts lies in the fact that it is necessary to go through *ALL* the accounts in order to prepare an abstract of the delinquents. One will find that the percentage of delinquent accounts is greater in those cities having either of these plans than those using the modern stub plan of accounting.

The latter plan provides the most expeditious, accurate and economical means for billing a large number of consumers at frequent

*Presented before the Central States Section, August, 1937.

intervals, as modern machines provide for the completing of bills without the ledger sheet and the ledger card. The bills thus comprise not only the bill to be mailed to the consumer, but the loose leaf ledger record and delinquent notice. Not only may these be printed and addressed at the same operation, but the completion of the billing data will give us all three units at one operation by means of machines that automatically set up controls as charges are billed. Post card bills mailed are delivered at one time insuring a definite period during which bills may be paid.

Payments received by cashiers are represented by the coupons detached from the bills and are quickly balanced by the cashiers and passed to the consumers' accounts clerks. The office records, which are really loose leaf ledger records, are removed from the files and a total taken of these cards and balanced with the cashiers' total, after which the office records are stamped "Paid", with the date. This gives us an absolute check upon the crediting of the payments, resulting in a day-by-day balance of accounts receivable. Starting with the date of mailing of the bills and the elimination of the paid accounts each day, we thus have a diminishing number of accounts to handle. Assume that there are two collection dates. Bills are mailed and are due in ten days. The experience of Cincinnati shows that approximately 3,000 accounts are unpaid on the tenth day after 12,000 bills have been mailed. The 9,000 which have been paid have automatically been balanced. Delinquent notices, prepared at the time bills are addressed, are then mailed out on the approximate 3,000 delinquent accounts, directing attention to the fact that the bill has not been paid and must be paid by a second date printed on the bill, which is ten days beyond the first date of payment (or a total of twenty days from the original date of mailing), or collection service will be involved, necessitating an additional charge of $1.00 for collection service.

At the conclusion of the second date of payment there are only 300 accounts remaining unpaid out of the original 12,000 bills on which 3,000 delinquent notices were mailed. We do not have to search for these. All the approximate 11,700 accounts have been eliminated from the accounts receivable files. We have only 300 unpaid accounts left, and the best thing to do with these is to collect them.

On the morning following the expiration of the second date of payment shut-off bills are prepared in triplicate. These bills are

prepared in fanfold form, on typewriters, as their number does not warrant preparation on the addressograph. The three copies, which are blue, gray and white, carry a replica of the billing information on the office record, in addition to the collection charge of $1.00. After all the bills have been prepared for the uncollected accounts, a journal voucher is prepared charging these accounts with the total of the collection charges.

These bills are then sent to the turnkey foreman. The turnkeys are experienced valveman, whose duties are to turn on and turn off water upon orders from the consumers, and they are bonded, in order that they may collect delinquent bills.

Of the three copies, the blue one is retained in the cashiers' cage. The gray and white copies are given to the turnkey foreman. The turnkey foreman then parcels out the white copies of the unpaid accounts to the turnkeys, retaining the gray copy as a follow up. The turnkeys then attempt to collect the bills. In this connection a statement of policy would not be amiss.

On the first call approximately 200 of the 300 accounts are collected; of the remaining approximate 100 accounts, most of them are not at home, and notices are left on the premises to the effect that the bill is delinquent and must be paid within 24 hours and include the amount due. On these accounts, a second call is made 48 hours later, and by that time most of the accounts will have been paid at the office. On the remaining approximate 25 accounts, most of them will be welfare or indigent cases, and where the turnkey can contact the consumer, the consumer is requested to call at my office, where arrangements will be made for him to pay the bill off in installments, if this is the only way he can pay the bill. Or, if a check has been expected, and has been delayed, or some source of income has been deferred, a further extension will be granted, so as to leave the consumer dealing with the office rather than have the turnkey make unnecessary calls.

To my knowledge, only the stub plan provides for a method of making partial payments, as I have not seen a ledger or ledger card plan adapted to provide for partial payments. In those cities permitting of the payment of bills in installments a subsidiary record is necessary, and here we run into added costs for accounting, in addition to a duplication of records with its incidental errors.

On accounts collected by the turnkeys, the remittances, together with the stubs of the white bills, are passed to the turnkey foreman,

who reports to the head cashier that these accounts have been paid, whereupon the cashier removes the corresponding blue slip from his files. Obversely, as delinquent accounts are paid at the cashiers' windows, the blue slip is stamped "PAID" and sent to the turnkey foreman, who in turn withdraws his gray copy and obtains the white bill from the turnkey, thus matching up all payments and eliminating any possibility of annoying the consumer who may have paid the bill at either one of the two sources. This procedure permits the head of the division to make a periodical check-up of the blue slips in the cashiers' cage to ascertain the status of the delinquent accounts.

Very few services are shut off on account of non-payment. Usually it is to be found that premises have been vacated, and the shut-off of a stubborn consumer brings him into the office the same day, eager and anxious to pay the bill. The latter instance, when once it occurs, has a definite psychological effect, and this consumer then knows that if he can pay and won't pay, that it is just too bad. As explained previously, considerate attention is given to those cases which justify such action, and a way is always found by which the account can be paid.

When additional time is given to pay a bill, beyond the due date, a tickler system is used in following up to see that these accounts have been paid when promised. Very rarely does the consumer fail to fulfill his obligation, for he knows that failure on his part to pay the bill, after he has been granted an extension, precludes his receiving this consideration on future bills. Naturally, it is to his advantage to make good his pledge.

Of course, the method of guaranteeing the account must be given some thought. In Cincinnati, water bills are held as a charge against the property, and the owner is responsible for the bill whether the account is in the name of a tenant, as agent for the owner, or of the owner himself, regardless of succession of ownership. Therefore, bills are rendered quarterly, and are all paid within twenty-five days after the original date of mailing. We must exclude final accounts, as these bills are rendered when service is terminated, and when not paid remain as a charge against the property. Water will not be turned on at those premises until this final bill has been paid; therefore, there are no losses from this source. It is my opinion that, in those cities where the property owner cannot be held responsible for water bills, even more rigid enforcement should be made than the method outlined in the foregoing. For, the longer an account re-

mains unpaid, it is just that much more difficult to collect it, and failure to collect such accounts results in losses to the water works.

After seven years' operation of the above procedure, the officials of the Cincinnati water works are highly gratified to observe that in the past five collection periods there were no delinquent accounts before the next mailing period took place. In other words, bills mailed on the 5th of the month, due on the 15th of the month, and past due on the 26th of the month, were all paid before the 5th of the following month when the next billing unit was mailed. There are no peak load periods. With the preparation and mailing of bills by the cycle or staggered system, a minimum of personnel is required for a maximum of production, for which mechanical methods of operation are accountable.

In 1930, 88,000 consumers had meters read monthly and bills were rendered monthly. One-sixth of this number received bills of 40 cents minimum and the cost of rendering these bills was 29 cents per bill. This was all out of proportion. A study was made and recommendations adopted. Bills formerly made up on non-adding typewriters and on which the controls were set up on adding machines and rendered on the first of each month, became due on the 20th of each month. Interim payments were posted to ledger sheets. From the 20th to the 28th all the efforts of the combined accounting forces was necessary to credit payments which resulted from the peak load, with the result that the ensuing month's bills were mailed without balances being carried forward. Delinquent bills were prepared on the unpaid accounts in the preceding month's ledgers on the 5th of the following month and efforts made to collect these bills or discontinue service for non-payment. Many were the instances where the consumer had paid the current bill and had neglected to pay the delinquent bill, resulting in a shut-off. Here was a beautiful situation for the promotion of favorable (?) public relations!

The new plan calls for reading meters quarterly, excepting large users, whose meters are read and billed monthly, together with quarterly billing. It eliminates the ledger plan and provides for the use of an automatic Addressograph and Burroughs Public Utility Billing Machines. Bills are mailed instead of being distributed by meter readers, thus releasing the latter for the work for which they are primarily employed and in which they are highly proficient. Day by day balancing eliminates peak load periods and averts

checking, which was formerly necessary under the ledger plan. A meter sheet comprising a chronological record of the consumer's account is the reference used for consultation with the public concerning their accounts. It contains the original notations made by the meter reader and is always convincing.

A comparison of the two methods may be likened to the antiquated procedure in many water works departments as against the modern methods used by private public utilities. Not only is the consumer given intelligent handling of his delinquent account, but the cost of billing and recording payments is materially reduced by the use of the stub plan.

Statistics are always interesting. Ninety-nine employees were required in 1930 for meter reading, billing and collecting, as well as turning water on and off, for 88,000 accounts. Today, with 100,000 active accounts, 60 employees, supplemented by machine production, take care of reading, billing and collecting for that number of accounts, and this work is done more accurately, more expeditiously and more economically than formerly. And looking at it from the consumer's viewpoint, it means this: The immediate saving of $125,000.00 in 1930, due to the change in consumer accounting procedure was the first step in a reduction of rates amounting to some $300,000.00 per year, on May 1, 1931, and a further increase in revenues without additional corresponding costs in operation permitted a second reduction of $265,000.00 per year on April 1, 1937.

We do not feel that we have yet reached "Utopia". We do believe, however, that the installation of a sound business practice, supplemented by the use of the mechanics and technique of modern accounting, have given results that may well be envied by less courageous Water Works officials. To collect all bills and maintain the good will of the consumers who are constantly alert to the fact that lower operating costs mean lower water rates, is an ideal well worth striving for.

Discussion by HAL F. SMITH.* I am sufficiently acquainted with Mr. Hoffman to know that he would be satisfied with nothing less than an outstanding achievement, but I was wholly unprepared for some of his statements. Particularly was I impressed with his statement that during the last five collection periods, all delinquent accounts were collected before the next current bills were rendered.

*Department of Water Supply, Detroit, Mich.

Or, in other words, there were no arrears to bring forward to the current bills. That statement, Gentlemen, gives us something to think about.

Later in his paper, he states that he does not feel that they have yet reached Utopia. I am wondering why not. We, in Detroit, have thought that we had done a pretty good job by reducing a delinquent balance of $1,200,000 as it stood at the peak of depression to a present balance of $175,000, most of which is covered by partial payment agreements or is an accumulation of small bills only one quarter in arrears. We have not yet, however, reduced the delinquent balance to zero and I know we never will.

Of course, I realize that Mr. Hoffman's statement is intended to exclude their unpaid final bills and I assume is intended to exclude those that are being carried on a partial payment plan. Even with the exclusion of these two classes of delinquent accounts, the Cincinnati department's achievement is remarkable. I can not help but wonder what it is that Cincinnati has that we in Detroit haven't that makes such an experience possible.

Mr. Hoffman apparently believes that it is the stub plan. I do not agree with him. The stub plan is a customer accounting plan, not a collection system. The customer accounting plan, whatever it may be, has no bearing on the collection policy or collection routine. It may be true that the stub plan facilitates establishing the delinquent list but it should be remembered that the work of the collection department does not begin until after the delinquent list has been established.

Well, if it isn't the stub plan that's doing it, what is it? Undoubtedly the bill paying habits of the class of citizens that make up the population of Cincinnati is responsible to some extent but that is not the entire answer. Certainly Mr. Hoffman and his staff should be given credit for the efficient operation of a well planned collection system.

I believe there is still another phase that contributes to their success. This is indicated by Mr. Hoffman in his description of the progress made in a typical group of accounts. As I recall the example, he states that 12,000 current bills were rendered in this typical unit and that by due date 9,000 were paid. This is 75 per cent. There is nothing unusual about that. This leaves 3,000 unpaid accounts, 3,000 out of the original 12,000, unpaid at due date. A delinquent notice is immediately mailed to each of these

3,000 delinquent customers and, lo and behold, 2,700 of them walk up to the counter and lay their money on the line within the next ten days. That is 90 per cent of all the delinquent customers and that is remarkable. I am not particularly interested in the remaining 300, assuming that the Cincinnati Department struggles along with them as best they can, the same as the rest of us, using the shut-off key as the last resort, but I would like to know what the magic of their delinquent notice is that brings 90 per cent of the delinquent customers to time within ten days. I believe Mr. Hoffman stated that this notice calls attention to the fact that if the bill is not paid within ten days, a $1.00 collection service fee will be charged to the account. That statement apparently is responsible for the remarkable phenomena of clearing 90 per cent of their delinquent accounts in ten days. This plan seems to work wonderfully well in Cincinnati; whether it would work as well or at all elsewhere is another matter.

I realize that Mr. Hoffman is an ardent advocate of the stub plan and undoubtedly for good reason. Please do not misunderstand me—I have no quarrel with the stub plan, but as a friend of the modern combination bill and ledger plan, I feel that a few statements regarding the ledger plan should be clarified. Mr. Hoffman stated that one will find that the percentage of delinquent accounts is greater in those cities using either the ledger or register sheet plan than in those using the stub plan of customer accounting. That may be so, I do not know, but if it is true, I am inclined to believe that it is due to a set of circumstances entirely apart from the kind of customer accounting plan in use. Certainly no proof to the contrary has been offered.

Mr. Hoffman also states that the stub plan provides the most expeditious, accurate and economical means for billing a large number of consumers at frequent intervals. The question of economy and expedition is a controversial point that has not yet been settled, but I can see no reason to make the claim that the stub plan is more accurate than either of the other two plans. He also states that only the stub plan provides for a method of making partial payments. I make the counter claim that not only does the combination bill and ledger plan provide for the posting of partial payments but that the posting of such payments is much simpler under the ledger plan than under the stub plan.

Mr. Hoffman also states that a meter sheet comprising a chrono-

logical record of the customer's account is the reference used under the stub plan for consultation with the public concerning their accounts. If I were arguing the merits of the stub plan, I would not mention this point. It is true, of course, that under the stub plan the meter sheet is used as the chronological record of the customer's account but it is used as such, not as a matter of choice, but because the stub plan provides no other chronological record of the account. Unfortunately the meter sheet is not a complete record in that it does not show the date or amount paid on the account. This lack of a complete chronological record of the customer's account is in my opinion one of the serious disadvantages of the stub plan.

As an indication that the stub plan is the most economical customer accounting plan, Mr. Hoffman cites the fact that the reading, billing and collecting of their 100,000 customers' accounts are handled by 60 employees. That is an average of 1,666 accounts per employee. In Detroit, under the combination bill and ledger plan, our 275,000 accounts are handled by 161 employees, or an average of 1,708 accounts per employee. I realize that a comparison of this kind is meaningless unless all facts concerned are taken into consideration. This comparison is not offered as a proof of anything, but only to indicate that the question of efficiency and economy between the two plans is still a debatable question.

Regardless of the fact that we are not in complete agreement on a few points, it is evident that Mr. Hoffman has done a remarkable job for his department in customer accounting and collecting.

THE IMPORTANCE OF WATER MAIN DISINFECTION*

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INTRODUCTION

Practical waterworks men have in the past paid little attention to disinfection of new mains and repaired mains. Flushing was, and still is, regarded by many water superintendents as an adequate method for removing chance contamination from new pipe lines. There is, however, a definite trend toward main disinfection, and the interest shown in this subject by waterworks men throughout the country merits some thought and discussion. The subject is not new, as it has been discussed in the literature for many years, but there still is an apparent lack of definite reasons justifying the disinfection of mains; otherwise the practice would be more firmly established. It is therefore the purpose of this paper to add specific examples from the state of Washington and to review briefly studies, papers, and cases from other states.

CAUSES OF MAIN CONTAMINATION

To be brief, the causes of main contamination may be listed as follows:

a. Contamination of pipe at factory or in shipment;
b. Contaminated hemp or jute used for packing;
c. Flooding of water trench with sewage during construction;
d. Voiding of urine or excrement into trench or pipe by careless workmen;
e. Trench dug in contaminated soil.

In addition, there is always the unavoidable foreign matter that enters a pipe during construction, and the ever present possibility that some of the workmen are typhoid or dysentery carriers.

* Presented at the Pacific-Northwest Section meeting, May, 1937.

CONTAMINATION AT PORT ORCHARD

Port Orchard, which has a population of about 1,200, is located on Puget Sound across the bay from Bremerton and about sixteen miles west of Seattle.

The city has no sewerage system, but the majority of homes and business houses have individual septic tanks and tile drains or sewers leading direct to the bay.

The water system is municipally owned and has its source in two artesian wells, drilled to a depth of approximately fifty feet and cased with six-inch and three-inch pipe respectively. The wells are located about one hundred feet from the bay and have a static head which produces continuous flow into a covered concrete sump. From this sump, water is lifted by a two-stage centrifugal pump directly into the system.

The old distribution mains were of wood stave and in need of replacement; therefore, the city requested and received approval on a P.W.A. project which called for 21,696 lineal feet of new cast iron mains for replacement. Construction started June 22, 1936, and through some oversight this project was never submitted to or approved by the State Department of Health; therefore, the usual provision calling for disinfection of mains was not made a part of the specifications.

A sample collected July 29 from the sump and submitted by the water superintendent showed the presence of coliform organisms (2 per 100 c.c.). Again on August 3 and 5 samples from the sump were submitted which were also positive (10 and 100 per c.c.). As a result of these indications of contamination an engineer from the State Department of Health was sent to Port Orchard on August 10 to make an investigation, as all samples collected in past years had consistently been negative for organisms of the coliform group.

The field investigation disclosed that no plan of main disinfection was being followed, and during construction the mechanical trencher had cut private sewer lines which allowed the ditch and pipe to become contaminated. The contractor was immediately instructed to place dry calcium hypochlorite in all pipe sections which were yet to be laid, but it was felt that these instructions were too late to prevent possible contamination.

The water superintendent was adding hypochlorite solution to the pump sump at one hour intervals, but as this was insufficient it was decided that the State Department of Health's emergency chlorinator

should be used to disinfect the mains. Consequently, this machine was set up at the pump house on August 12 and two engineers from the department mapped out a program of main disinfection. With the aid of the water superintendent this plan was carried out. All sections of pipe were blocked off, chlorinated up to the capacity of the chlorinator, allowed to stand for one or two hours, and then flushed. Residual chlorine determinations made at fire hydrants gave from two to five parts per million.

Chlorination was completed the following morning and the water superintendent instructed to collect samples four days later. During this period no chlorination was employed as it was thought that the mains were adequately disinfected. However, when these samples were analyzed they showed high contamination (10, 100, 100, and 1,000 coliform bacteria per 100 c.c.). Fortunately, no new positive samples were taken from the pump sump, and it was logical to assume that the source of supply was not contaminated, as the original few positive samples from the sump were caused by a leaky check valve which allowed contaminated water to seep back through the pump. (This theory was later substantiated.)

As a result of this continued contamination, the portable chlorinator was taken back to Port Orchard on August 20 and installed by engineers from the State Department of Health. Continuous treatment, giving a residual of 0.3 p.p.m. after ten minutes of contact was then started. During this period of chlorination, which ended on August 25, samples collected from the distribution system were negative. However, samples collected on August 27 and 31 again showed evidence of gross contamination, as did samples collected on September 1. As a result, continuous chlorination was recommended and on September 4 the Wallace and Tiernan representatives installed a chlorinator at the pump house.

Chlorination was continuous again between September 4 and October 8, and on the latter date was discontinued. During the period of continuous treatment daily samples were collected from the distribution system and the pump sump, and during this time no contamination was evident. Samples were collected in special bottles containing sodium thiosulphate in order that the excess chlorine would be neutralized immediately.

After chlorination was discontinued on October 8 daily samples were collected, and with the exception of five samples which showed only two or four organisms of the coliform group per 100 c.c., the distribution system was apparently clean.

Bacteriological Record—Port Orchard

Coliform group tests

DATES	NUMBER OF SAMPLES		10 CC. PORTIONS POSITIVE		10 CC. PORTIONS NEGATIVE		REMARKS
	Pump sump	Distribution system	Pump sump	Distribution system	Pump sump	Distribution system	
May 13, 1935 June 3, 1936	1	5	0	0	5	25	Before reconstruction of mains
July 29, 1936 Aug. 11, 1936	5	7	11[a]	20[b]	14	15	During construction and before chlorination
Aug. 17, 1936 Aug. 20, 1936	2	12	0	55	10	5	After first heavy chlorination Aug. 12
Aug. 21, 1936 Aug. 24, 1936	4	1	0	0	20	5	During chlorination, Aug. 20–25
Aug. 26, 1936 Sept. 1, 1936	1	16	1	67[d]	4	13	Period of no chlorination, Aug. 26–Sept. 4
Sept. 7, 1936 Oct. 8, 1936	17	22	0	0	85	110	During 2d chlorination period, Sept. 4–Oct. 8
Oct. 12, 1936 Dec. 31, 1936	1	19	0	7[e]	5	88	No chlorination
Jan. 1, 1937 May 1, 1937	5	8	0	0	25	40	No chlorination

[a] Maximum = 100 coliform bacteria per 100 c.c.
[b] Maximum = 10,000+ coliform bacteria per 100 c.c.
[c] Maximum = 1,000 coliform bacteria per 100 c.c.
[d] Maximum = 1,000 coliform bacteria per 100 c.c.
[e] Maximum = 4 coliform bacteria per 100 c.c.

An examination of the accompanying table will show that the removal of fecal type organisms from the distribution system was not easily accomplished. Contamination continued to manifest

itself up to November 18, a total of 98 days after the first attempt was made at disinfection. It is significant to note that neither hemp nor jute was employed as packing.

Four basic conclusions may be drawn from this experience.

First: More care should be exercised in laying mains and excluding sewage pollution from water trenches.

Second: Mains should be carefully disinfected by high doses of available chlorine with a period of contact sufficient to kill all fecal type bacteria.

Third: New or repaired mains should not be put into service until bacteriological samples show them to be free from contamination.

Fourth: Ordinary check valves will not prevent back seepage and subsequent contamination.

It is fortunate that no epidemic of waterborne disease resulted from the Port Orchard experience, but the reason for this can probably be attributed to the fact that notices were posted in the local newspaper to boil all drinking water during the period of high contamination.

CONTAMINATION OF WATER BY JUTE AND HEMP PACKING

Gettrust (1) reports an experience at Akron, Ohio where contamination in new mains persisted after numerous flushings and treatment with chlorine. The mains were laid with care and HTH placed in each joint. After completion the line was filled with water and allowed to stand over night, but bacteriological samples collected after flushing were positive for organisms of the coliform group in 1 c.c. portions.

A procedure of treating with heavy doses of HTH, allowing twenty-four hours contact and then collecting samples was repeated twelve times over a period of about three months before samples showed negative in 10 c.c. portions.

Samples of jute and hemp used for packing were examined, and for the jute positive coliform group tests were found in 0.001 c.c. portions, and for the hemp in 1 c.c. portions. Samples of water collected from blocked-off sections where jute was used and where hemp was used substantiated these tests.

It is inferred that contamination of mains through jute or hemp packing has no practical significance when interpreted in the light

of waterborne disease statistics, but it is also recommended that these packing materials be sterilized by steam under pressure before being used.

Kehr (2) reports that unsterilized mains continue to show contamination lasting three to twelve months and averaging six and one-half months in nine cases.

Spaulding (3) states, "There is ample evidence that the coliform group has been found so profusely under apparently innocent circumstances that it has been somewhat discredited as an index of pollution in those circumstances". The writer however does not agree with this statement. The coliform group is accepted as an indicator of contamination in waterworks practice; therefore, if a known source of non-fecal organisms can be eliminated by sterilization of packing materials it will place more significance on the presence of these organisms when they occur in water supplies.

Kingsbury and Adams (4), after studying the contaminating influence of jute packing, concluded that this material was almost as satisfactory as nutrient agar in providing a medium for the growth of coliform organisms. They also found that a typhoid strain grew well on jute media. This conclusion tends to support the writer's contention and refute Spaulding's statement, for if *Eberthella typhi* will grow on jute media there can be no compromise in considering the coliform group as indicators of contamination.

OTHER EXPERIENCES WITH MAIN DISINFECTION

Smith (5) reports that a thirty inch main which had been contaminated by sewage was chlorinated with a portable maching using an average dose of 12 p.p.m. After flushing, tests showed negative for organisms of the coliform group, and the total count was only 1 or 2 per c.c.

Almquist (6) states that in Connecticut where HTH or Perchloron is used the recommended dose is 0.5 pounds per 100 feet of pipe. This gives 18 p.p.m. chlorine in a six inch pipe or 3 p.p.m. in a sixteen inch pipe.

WASHINGTON PRACTICE

The Rules and Regulations of the State Board of Health require that all new wells and pipe lines shall be disinfected in an approved manner and thoroughly flushed before being placed in operation.

To accomplish this the department issues recommendations giving a choice of disinfection by Perchloron or HTH and by portable main sterilizers. A table accompanies these recommendations in which quantities of high-test hypochlorite sufficient to give 50 p.p.m. chlorine for each size of twenty foot length of pipe is given.

EPIDEMIOLOGICAL SIGNIFICANCE OF MAIN DISINFECTION

Wolman and Gorman (7) list two definite epidemics attributed to contaminated mains which were not disinfected before being put into use. In one instance there were thirteen cases of typhoid fever and one death. For the other, twenty-seven cases and two deaths.

There are probably many other epidemics and numerous isolated cases that belong in this same classification which have escaped notice because of the difficulty in determining the source of infection.

CONCLUSIONS

1. New water mains are easily contaminated during laying.
2. Contamination by fecal matter which showed up to 10,000 coliform group organisms per 100 c.c. was found in non-disinfected mains at Port Orchard, and after the mains were originally contaminated, positive samples continued for 98 days even though mains were treated with high chlorine doses.
3. Jute and hemp packing have been found to be a source of contamination.
4. Typhoid bacteria have been grown on jute media.
5. Washington practice calls for disinfection of mains and recommends high chlorine doses (50 p.p.m.) with at least three hours contact.
6. Epidemiological evidence points to the danger of putting non-disinfected mains into service.
7. New or repaired mains should not be placed in service until bacteriological samples meet state health department standards.
8. Sections dealing with disinfection of mains should be a part of all contract specifications pertaining to water supply lines.

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SOME PROBLEMS CONFRONTING WATER WORKS OFFICIALS IN CONTROL OF WATER-BORNE DISEASES*

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The effective control of water-borne diseases constantly offers innumerable problems in the protection of water at its source, in the highly technical processes of purification, and in the safe delivery of water to the consumer. In the average well designed, constructed and operated water supply solution of the majority of the problems has been reduced to a more or less well regulated routine and the regular delivery of contamination free water is accepted as a matter of course by both water works officials and consumers. However, it is not the usual but the unusual occurrences that cause epidemics of water-borne diseases. Water works officials are not discharging their full responsibility to the public if they fail to make every effort to foresee and provide against unusual circumstances.

Unusual conditions affecting the water supplies of several towns in the State have come to the attention of the Tennessee Department of Public Health in the past three years. Of these, four are thought to be of sufficient interest to justify presentation at this meeting. It is hoped that a discussion of these occurrences will contribute toward impressing on water works officials the possibility and danger of unusual conditions arising in even the well operated water plant; that a description of the methods of investigation and correction employed will be of benefit to those who may sometime be faced with similar problems; and that a presentation of questions that came up during the investigations and have not yet been answered may provide food for thought.

For obvious reasons the towns involved will not be called by name,

* Presented at the joint meeting of the Southeastern and Kentucky-Tennessee Sections, 1937.

but will be identified as Alpha, Beta, Gamma and Delta respectively. In the town of Alpha the resistance of the water works official's enemy, the coliform group of bacteria, was demonstrated. In Beta the evils resulting from neglect of an essential treatment process were shown. In Gamma the mystery of an epidemic of gastro-intestinal disturbances arising from an apparently satisfactory water was encountered. And in Delta the laws of chance were flouted by a set of coincidences that caused one of those things that "never could happen" to occur.

FLOOD WATER POLLUTED MAINS

The town of Alpha with a population of 10,000 uses a river as its source of water supply and employs the processes of coagulation, sedimentation, filtration and disinfection as commonly used in the treatment of surface supplies.

The recent flood put the water plant out of commission by covering the station floor with five and one-half feet of water. Several swimming pools had been filled with treated water from the plant before it had to be shut down and this water was distributed in barrels for drinking and cooking, with the usual extra dose of chlorine and advice regarding boiling. It was evident that the plant could not be put back into operation for several weeks and in the meantime it was necessary to provide water for sanitary purposes and fire fighting. A temporary pump and chlorinator were set up at the edge of the backwater below the points of discharge of several sewers, and river water, dosed with three parts per million of chlorine, was pumped into the distribution system.

After the water receded the question of how to clean up the distribution system presented itself, and the "Old Reliable—Chlorine" appeared to be the answer. The treatment plant had not been damaged seriously and was put back into service. Normally four pounds of chlorine per day is used for disinfection. The pre-chlorinator was set on ten pounds and the post-chlorinator on forty pounds per twenty-four hours, and the battle with coli-aerogenes was on. In addition a flank attack was made with a main sterilizer on the opposite side of town where twenty pounds per day was injected into the distribution system. Thus seventy pounds of chlorine per day, or a dose of about 6.5 parts per million was pumped into the system and after two days a strong residual was obtained at the most remote dead ends.

The main sterilizer was abandoned, but the high dosage was maintained at the plant. Starting at the plant and working away from it in concentric zones every fire plug was flushed until minimum chlorine residuals of 3.0 parts per million and maximum turbidities of 10.0 were obtained. A week was required to complete these activities and then at a prearranged signal from a wild cat whistle all house fixtures in town were opened by the consumers and flushed for thirty minutes. The pressure at the water plant dropped from 95 to 55 pounds per square inch, and consumers on the higher elevations could get no water until the flushing period was completed. The chlorine dosage at the plant was cut back to give a residual of 3.0 parts per million and when an old Negro asked by phone "Boss, is de water fitten ter drink now?" he was answered in the affirmative.

It appeared that the boast of victory was a bit premature, however. The residual of 3.0 parts per million was maintained at the plant for another week, and then cut back to 0.5 parts per million. Immediately the coliform organisms, which for two weeks had been subjected to fifteen or more times as much chlorine as is considered necessary for their destruction, began to come to life, first at the outskirts and then in the middle of town. The chlorine residual was again increased to 3.0 parts per million and the process of flushing repeated. After five days the residual once more was reduced to 0.5 parts per million and this time the coliform bacteria were found to be routed completely.

Incidentally, during this period not one complaint regarding chlorine tastes was received by the water department. That is one to tell those consumers who complain about a measly residual of 0.3 to 0.4 parts per million.

INADEQUATE CHLORINATION

The town of Beta has a population of about 500. Its privately owned water supply comes from a limestone spring and disinfection with hypochlorite solution is the only method of treatment employed.

The first report that all was not well in Beta came when a large organization set up headquarters for a field unit in the town. Twenty-eight of the first twenty-nine employees sent there underwent attacks of diarrhea within a few days. After recovery no further inconvenience was suffered unless an individual left town. Upon returning to Beta he would again have diarrhea. The experience of all employees subsequently stationed there was similar to that of the first

group. A hurried epidemiological survey revealed that natives were practically immune to the diarrhea unless they left town for a time and thus lost their immunity. Indications were that the water supply was the carrier of the infective agent.

The history of monthly water samples submitted by the owner of the supply for bacteriological examination indicated an entirely satisfactory water from the standpoint of bacterial quality. From evidence collected during the epidemiological survey the epidemiologist believed that some unusual chemical content of the water might be the causative factor, and a thorough chemical examination as well as a bacteriological study was instituted.

Magnesium sulfate (Epsom salts) was suspected at first, but analysis revealed only 20.0 parts per million in the water and it was calculated that a person would have to drink about sixty-five gallons a day to obtain a laxative effect. It was not believed that anyone in Beta drank that amount of water so this possibility was dismissed. Other constituents revealed by the ordinary proximate analysis were not usual in any respect. Special analyses for other metals including lead, mercury, arsenic, antimony, copper, tin, manganese, nickel and zinc failed to show the presence of any except zinc. 2.3 parts per million as metallic zinc was found in the distribution system but this evidently had been picked up from the galvanized iron pipes in the system and was not enough to cause trouble.

Analyses for ammonia, nitrites and nitrates revealed a rather high nitrate content, indicating that the water may have been subjected to a fairly heavy organic pollution sometime in the past. This possibility was supported by a rather high chloride content that indicated the organic pollution might have been of a fecal nature. Attention was directed to a small sewerage system with about fifteen connections discharging into a sink hole six hundred feet downstream from the spring. One hundred pounds of salt in solution was fed into the sink hole and the spring analyzed for chlorides daily for a period of two weeks, but no increase in chlorides was found.

During the course of the investigation one fact slowly came to light. When the owner of the supply knew beforehand that a representative of the Health Department was scheduled for a visit, samples from the distribution system showed no coliform organisms. When he was not forewarned similar samples invariably were badly contaminated. At the end of the investigation he was told in no uncertain terms that the only trouble found had been neglect of

disinfection, and that if conscientious disinfection failed to remedy the condition it might be found necessary to condemn the supply. No more complaints of diarrhea have been received from Beta.

The most interesting finding in this investigation, which has not yet been explained, was the apparent immunity developed after the initial attack of diarrhea.

SEWAGE POLLUTED SPRING

Gamma, a town of 2,500, also obtains its water supply from a limestone spring and employs chlorination as the only method of treatment.

Reports of an unusually high incidence of gastro-intestinal disturbances became so persistent that a thorough epidemiological survey was made. This study showed that the reports were well founded and indicated that the public water supply was probably the carrier of the infective agent. The survey brought out one factor that was significant and appeared to offer a promising lead in the investigation of the water supply. The majority of the cases of diarrhea found were reported to occur on or near week-ends. This appeared to indicate that a routine operation occurring with some degree of regularity might be at the bottom of the trouble. An incorrect interpretation of this factor started the investigation in the wrong direction and probably delayed the final solution.

Four cross connections to the distribution system were found in industrial plants. One of these in particular appeared quite dangerous, with sewage polluted water separated from the city system by a single check valve. A fire pump in the plant could develop two hundred pounds per square inch pressure against this check valve and the eighty pounds pressure on the city distribution system. Persistent questioning, both indirect and direct, of men in all four plants failed to reveal any regularity of operation of the cross connected systems that would account for the week-ending distribution of diarrheal outbreaks. The fact that they were not involved in this particular instance does not justify their existence, for such connections are potentially extremely dangerous.

An educational institution is situated on the highest hill in town, and a booster pump is necessary to furnish water pressure for the upper floors of the dormitory. This pump is shut off each night and there appeared to be a possibility of back-siphonage from dormitory fixtures when the pressure was reduced. A thorough investigation

revealed that all toilets were of the flush tank type and no fixtures that might siphon back were found except lavatories and bath tubs with below the rim inlets. Obviously any contamination from these sources would be only occasional and very slight.

Investigation of the open elevated tanks revealed nothing but a rather heavy growth of algae and one dead bird.

A thorough investigation of chlorination was made. Iron, manganese or nitrites in sufficient quantities to interfere with determination of chlorine residual by the ortho-tolidine method were not found. Measured by the liquid color standards used for determining chlorine residuals at the plant a residual of 0.3 parts per million was maintained, but the standards had faded so badly that the actual residual was only 0.15 parts per million. In addition the water was found to exert a chlorine demand of 0.04 parts per million. Since chlorine residuals always had been determined immediately after application of chlorine no contact time had been allowed to correct for the demand. Thus the 0.3 parts per million residual that the operator thought he had been maintaining dwindled to 0.1 parts per million, which is dangerously close to the minimum considered safe. Due to use of water by industrial plants, pressure on the distribution system usually fell from seventy-five pounds per square inch on Mondays to seventy pounds on Fridays when the plants shut down. Over the week-ends the pressure again rose to seventy-five pounds. Measurements of pump discharges at these pressures showed deliveries of 260 gallons per minute at seventy-five pounds and 315 gallons per minute at seventy pounds or an increase of 21.2 per cent for a five pound decrease in pressure. No change in the rate of chlorine application was made to compensate for this unsuspected increase in pump capacity and taking into consideration the low chlorine residual being carried, it began to appear that the investigation was making headway. In particular these findings appeared to fit in with the week-end prevalence of diarrhea.

The rate of chlorine application was increased to give a residual of 0.25 parts per million and time was taken out for a breathing spell which appeared to have been well earned. Once again the boast of victory was premature for diarrhea continued unabated.

Finally a routine visit to the end of a terra cotta city sewer which passes within sixty feet of the spring revealed the complete absence of any sewage discharge. This sewer serves about seventy homes and obviously there always should be some flow in it during daylight

hours. Previously a complete absence of discharge had never been noted. A hasty check of manholes revealed a steady flow at the upper end of the line but only an intermittent flow at the lower end. A bit of deduction and digging uncovered a break in the line where the ends of two lengths of terra cotta had tilted downward directly over a sink hole two hundred feet from the spring and at an elevation of about forty feet above it. During low sewage flows this break allowed all of the sewage to discharge into the sink hole, but during higher flows a portion of the sewage jumped the break and continued on to the creek. The chlorine dosage was immediately increased to 0.75 parts per million and the leak in the sewer stopped. Salt solution was introduced into the sink hole with a stream of water estimated to be about equal to the flow of sewage and within ten hours chlorides were detected in the spring. This left little doubt of the existence of an underground connection between the spring and sink hole.

Incidentally the salt experiment furnished the investigator one of the really bad frights of his existence. The stream of water accompanying the salt solution was started into the sink hole one morning and permitted to continue all day and night. On returning to the plant on the morning of the second day the operator was found to be feverishly taking samples for chlorine residual determinations, hastily dumping them and speeding up the chlorinator between each sample. When he calmed down sufficiently to permit a sample to stand several minutes a reassuring residual developed and a check on the distribution system showed safe residuals at all points. Apparently the stream of water in the sink hole had flushed decomposing sewage with a high content of ammonia into the spring. The addition of chlorine formed chloramines with a slow reaction to ortho-tolidine. This source of ammonia is not recommended for general use.

The terra cotta sewer has been replaced by cast iron pipe with leaded joints; the turbidity of the spring has been reduced from a recorded high of 340 in rainy weather to a very occasional maximum of 25, which of course is still higher than desirable though not unusual for a limestone spring; the most probable numbers of coliform bacteria in the raw water have been reduced from a record high of 240,000 plus per 100 cubic centimeters with numerous samples showing 24,000 per 100 cubic centimeters to an occasional modest maximum of 230 per 100 cubic centimeters; and diarrhea no longer spends the week-ends in Gamma.

In spite of these accomplishments several questions remain unanswered. Why was the incidence of diarrhea higher on week-ends than in the middle of the week? Did the increase in pump discharge toward the end of each week play a part, or was there some regular daily variation in sewage flow that caused it? Possibly a combination of the two may hold the answer. During the period of two months covered by the investigation daily samples were collected from five points on the distribution system both before and after increasing the chlorine dosage. Of these only two contained coliform organisms and in each case only one out of five 10 cubic centimeter portions was positive. On this basis the bacterial quality of the water was well above the minimum requirements of present day standards. How did such a water transmit diarrhea to the consumers? Possibly Gamma will take a place beside several other towns that in recent years have suffered mysterious epidemics of gastro-intestinal disturbances. These outbreaks followed unusual and excessive contamination of the sources of water supply in spite of careful treatment that produced water which met present standards for potable water.

INADEQUATELY PROTECTED WELL

Delta has a population of 9,000. Its water supply comes from the deep wells of west Tennessee that are well known for their freedom from contamination. Treatment consists of moderate aeration and filtration for the removal of iron, but no disinfection.

The water plant is situated on the bank of a small river. A city sewer passes down the street in front of the plant at right angles to the river. At the corner of the plant the sewer turns downstream, passes between the plant and the river, and discharges several hundred yards below. One well is situated near the river about two hundred feet below the plant and the sewer passes between the well and the stream. This is a flowing well and an overflow line connected into the casing several feet underground and equipped with a gate valve allows the well to discharge to the river bank when not in use. Formerly a gravity line also several feel underground carried the water to the plant. In recent years a deep well turbine pump was installed on the well to increase its yield. The discharge line from the pump was brought outside the pump house above ground, turned down and teed into the old gravity line with a gate valve between the tee and the well.

The recent flood set in motion a number of unpredictable coin-

cidences that caused about 3,000 cases of diarrhea but, so far as is known, no typhoid cases and no deaths. The first coincidence was the height to which the river rose, surpassing all previous flood records. It stood eighteen inches above the floor of the water plant which was kept in operation only by agonizing hours of sand bagging and frantic bailing. The second coincidence came when back pressure from the high water caused a manhole cover on the sewer above the plant to blow off and permit sewage to boil into the river above the well. The third coincidence occurred when the river submerged the overflow line from the well. Even this would not have caused serious contamination of the water supply if human fallibility had not permitted a fourth coincidence. When it became apparent that the well overflow line would be submerged by the rising flood a man was sent to close the valve. Either through ignorance or in the excitement of the moment he checked the valve on the old gravity line to the plant, found it closed and left the overflow valve open. When the river flooded the overflow line river water, probably carrying sewage, entered the wall and was pumped through the plant into the distribution system.

When turbid water was noticed in the distribution system boiling notices were published in the local paper but these were rather mild in suggesting the desirability of boiling all drinking water, reached only subscribers to the paper and apparently were not effective. In such an emergency notices should be issued in the form of handbills placed directly in the hands of at least one member of each family and displayed in public places, and should be stated in words strong enough to frighten consumers into taking the necessary precautions.

A chlorinator was moved from a local swimming pool to the water plant, cylinders of chlorine were obtained from a textile plant and the chlorinator was set to give a 1.0 part per million residual. This residual was considered sufficient since the turbidity in the distribution system, after having passed through the filters was not excessive and consisted of fine particles. The usual flushing operations were carried out and after two weeks bacteriological samples showed no contamination and the boiling notices were recalled.

The effectiveness of these activities was hindered to some extent by one of the local officials. He was convinced that the Health Department was making much ado about nothing, and made no effort to keep his convictions to himself. It would have been less than human not to have felt a certain amount of satisfaction when,

after the necessary incubation period, he joined the ranks of the 3,000 sufferers. But it was disconcerting to learn than his attack was due to something he had eaten, in spite of the evidence of water samples that showed extreme contamination.

It was even more disconcerting, however, to learn from numerous local sources that the entire epidemic had been caused not by contamination of the water supply but by that stuff the Health Department had put in the water. It even killed gold fish!

These four examples of the unusual have been selected and discussed to show that the unusual not only can but often does occur, and all too frequently with serious results. Water works officials, possibly more than anyone else in a community, are charged with a great responsibility for the health and lives of its citizens. And it is doubtful that anyone can appreciate fully the enormity of this responsibility unless he has lain awake in the stillness of the night wondering if some action he has taken will insure the continued well being of those depending on him, or if something he has failed to do will result in untold suffering and even death.

DISCUSSION

J. E. JAGGER:[1] I am sure you have all been interested in the several examples Mr. Kittrell has given. It occurs to me that we should have a general discussion of this subject, and I hope there will be comments by men here who have had problems in protecting the quality of water. Also, I think it would be interesting if any of you have information of the widespread occurrence of diarrheal or gastro-intestinal disturbances which apparently have not been accounted for. I am impressed more and more with the general occurrences of ill defined outbreaks of mild diseases, which although they do not result in deaths as the old typhoid fever epidemics did, undermine confidence in the water supply of the community. I hope there will be discussions of this subject, and we would like to open the general discussion now.

W. W. BRUSH:[2] Mr. Chairman, I would like to ask Mr. Kittrell whether in Alpha the condition was probably caused by the coli being protected by the sediment in the mains.

F. W. KITTRELL: That is my belief that they were protected from the chlorine by the presence of turbidity in the mains.

[1] Chairman, Southeastern Section A. W. W. A., Birmingham, Ala.

[2] Editor, Water Works Engineering, New York, N. Y.

W. W. BRUSH: I have a very sympathetic feeling toward that situation because some twelve years ago New York laid a trunk main in the Rockaways where the sand is very badly polluted by sewage. At that time the sewage of the Rockaways was apparently carried in open jointed pipe. With the change of tide, the sewage flow was affected; at high tide, the sewage flowed in, and at low tide it flowed out. Therefore the sand was thoroughly contaminated and because of the necessity of laying the mains below water level a great deal of this contaminated sand got in the water pipes. The mains were badly needed at the time and after having them chlorinated for, as I recall it, a period of about three days with three to five parts residual they were put into service. Within about twenty-four hours there was a very general outbreak of diarrhea in the Rockaways. We had sterilized only the surface of the sand that was in the mains. We tried to flush it out, using hydrants, but we were unable to produce sufficient velocity to bring the sand up into circulation and to be carried out in suspension. The result was that the coli in the sand came to the surface after the highly chlorinated water was drained out. To remedy that situation, we put a twenty-inch blow-off on the thirty-inch main at the end and flushed with that full open until the sand was forced out. Then we chlorinated again, received satisfactory bacteriological reports from our laboratory and had no further trouble. But for three weeks following that incident my night's sleep was not very comfortable or continuous; and it is illustrative of what may happen even though you chlorinate. Something may go wrong. You do not get penetration if you have any substantial amount of material in your mains. The coli are protected by that material. I think it is similar in a way to the situation you had in Alpha.

W. J. ELDRIDGE:[3] I have had a couple of similar experiences. One especially I think would be of interest, was the moving of old mains that had lain open in the ground for a long time although not in sewage infected territory. We extended our lines some time back with used pipe. Before we put it into service we made the necessary checks and found that the water contained coliform bacteria. In fact, five out of five tubes would show gas. We chlorinated the lines with a high chlorine residual—three thousand parts per million—and it took three weeks to approve the water for use.

N. M. DEJARNETTE:[4] Early in 1936 the attention of the Alabama

[3] Supervisor, Water Department, Old Hickory, Tennessee.

[4] Sanitary Engineer, State Department of Health, Atlanta, Ga.

and Georgia State Health Departments was called to the fact that for approximately one year sporadic outbursts of dysentery had been occuring in the Chattahoochee Valley section centering around West Point, Georgia and Lanette, Alabama.

The number of cases increased materially in December, 1935 and January, February and March, 1936 until a total of approximately 130 cases were finally reported. A joint survey was made by representatives of the Alabama and Georgia State Health Departments, the United States Public Health Service and other epidemiologists. All reported cases were investigated, histories taken and both microscopical and cultural examinations were made of stool specimens.

It was learned that the cases were mainly confined to white adults and that clinically the symptoms did not resemble bacillary or amoebic dysentery. The laboratory examinations of stool specimens failed to reveal any organisms which could be associated with this outbreak.

In the beginning of this investigation the milk and water supplies were considered as possible modes of transmission of the causative agent, however, it was soon found that apparently the milk was not involved.

There was some difference of opinion as to the part played by the water supplies. At least one epidemiologist contended something contained in the water, possibly industrial wastes of a chemical rather than bacteriological nature was responsible for the epidemic. Others were equally as certain that the water supplies were not responsible.

This area is served by two supplies one of which normally takes water from a creek but under partial flood conditions receives back water from the Chattahoochee River; the other supply is obtained from the river. Both supplies received coagulation, sedimentation, filtration and chlorination and bacteriological samples conformed to the Treasury Department Standards. Neither plant received highly technical operation but the water treated had been considered safe. Certain operating records were kept including the amount of water treated, chlorine used and chlorine residual.

The distribution systems are inter-connected and water is interchanged from time to time. However, there was no record of such an interchange having occurred just prior to this outbreak, although several times during this period the Chattahoochee River was at a flood stage and both plants were filtering river water.

While the cause of this outbreak and its method of transmission has never been satisfactorily established in the opinion of most of

the investigators at least two ideas are of interest to water works men:

If the water plant at West Point had not had certain operating records and regular bacteriological examinations the finger of suspicion would have pointed much more strongly to the water. If some chemical or industrials wastes in the water were responsible for the outbreak what would be their probable nature and what additional tests should be included in routine examinations in order to evaluate the probable safety of a water?

A. E. GRIFFIN:[5] This discussion on diarrhea in water supplies reminds me of one experience I had in connection with a steamship. A steamship that goes on Southern cruises left New York with a supply of water taken from the Jersey City supply which passed the Treasury Department standards. Everything went well until they reached the warmer climate, and then within three days nearly the entire passenger's list was down with dysentery, to a greater or lesser degree. They got over this within a few days. The officials were somewhat upset because of the outbreak. On the next trip bacteriological tests of the water were made daily, and they found that the total bacteria increased as they entered southern waters. I don't remember whether or not they found any coliform bacteria, but there were certainly a lot of gas forming bacteria. On the third trip, they installed chlorinating devices and maintained a residual up to the filters. The diarrhea was much less on this trip. But the next time the ship was in port they went over the system with a fine-tooth comb and this is what they found: They carried the drinking water supply in the hole, that is, the very bottom of the ship. There is a space between the inner and outer shells of the ship's bottom and the drinking water was between the two. It was then pumped into a tank on the top deck and there filtered. That ship was built in 1916, if I remember correctly. The filters contained carbon bearing material. We took samples of it and found coliform bacteria growing in the filter. We found a lot of sludge and these organisms were more dense in the sludge. On the next trip they increased the chlorine but unfortunately the steamship went on the rocks down at Jamaica somewhere and the passengers were transferred to another ship.

W. W. BRUSH:[2] Mr. Chairman, I think maybe it will be of interest to state that in the city of New York single chlorination of the supply

[5] Research Engineer, Wallace and Tieman Co., Newark, N. J.

was originally employed. There was no filtration, the water being obtained from a surface supply and dependence largely placed on sedimentation and chlorination. Gradually the chlorination has been increased so that the Catskill water is chlorinated three times before it goes to the consumer. The various streams in the watershed, where there is likely to be pollution, are chlorinated separately before entering the reservoir. Usually, before distribution, the water is chlorinated twice in addition to this preliminary sterilization. I have no statistics at hand, to show what has been the result in the health of the community, but both Dr. Hale and myself believe from more or less hearsay evidence that, with each increase in the protection afforded by additional chlorination, there has been a decrease in the number of intestinal upsets. I have talked to doctors and they report that intestinal upsets in New York, where people are using that water supply, have diminished so that now they are at a very low level. I think it is of some interest to point out that whereas we thought that, with single chlorination, we had a reasonably well sterilized water, by doubling the points of treatment, we made it practically certain that not one drop of water could pass both chlorination plants without being adequately sterilized. Generally the chlorination plants would be working approximately one hundred per cent for all except a few hours in each year and it would be almost impossible for both plants to fail at the same time. With double chlorination it does seem that we have secured a definite improvement from the viewpoint of diarrhea and intestinal upsets in the city.

F. W. KITTRELL: Mr. Brush brought out the fact it was necessary to flush the newly laid line in New York quite thoroughly to remove the sand before satisfactory results were obtained. That is similar to the experience we had in the town of Alpha. Our worst samples came from the end of a very long dead-end. There was a very low flow of water in this particular main, so it was difficult to flush the sediment. A fire pump was attached to the last hydrant on the dead-end and after it was flushed thoroughly the trouble cleared up there.

In regard to Mr. Griffin's experience on the steamship, he said the trouble did not show up until warm weather was encountered. That bears out our experience in the town of Gamma. Diarrhea was encountered mainly in warm weather, but we have every reason to believe that the sewage had been going into the spring both winter and summer.

WINTER SEASON CONTROL OF A WATER WORKS SYSTEM*

By W. E. MacDonald

(City Water Works Engineer, Ottawa, Ont.)

In presenting this subject, it is my intention to stress chiefly the conditions which have been encountered in the city of Ottawa and the methods which have been formulated to ensure the efficient operation of the system during extreme sub-zero weather.

Our special problems can be attributed to the nature of the soil, the continuous sub-zero temperatures, which extend from the beginning of November to the latter part of March, together with the absence of snow on city streets. This condition is not present to the same extent in the majority of other Canadian municipalities.

In recent years the city of Ottawa has instituted a "Snow Removal Policy" on all city streets, which without doubt has created increased difficulties from frost to the distribution system. This policy however, has been considered of inestimable value to the general public and merchants of the city in facilitating transportation and improving business conditions.

SOURCE OF SUPPLY

In the Ottawa River, the source of supply, frazil ice is formed in the late fall by the water passing from Lake Deschenes over three sets of rapids where the temperature is reduced to the freezing point. The water flowing to Lemieux Island, the site of the low lift pumping station, is on occasions, heavily laden with needles of frazil.

With the knowledge of the foregoing fact the water purification and pumping plant was erected immediately adjacent to a specially constructed sedimentation basin which is equipped with two intake ports. The summer port is located in the north wall of the sedimentation basin paralleling the current, while the winter port is situated in the east wall of the basin at right angles to the current and facing downstream towards the bay. When cold weather sets in, the summer port is closed and consequently frazil is then carried

* Presented at the Canadian Section meeting, 1937.

past the sedimentation basin by the current while the water is drawn through the winter port from the bay, which is comparatively free of frazil.

As a further means of reducing troubles from frazil ice it is planned to install two sets of travelling screens in the winter port. These screens to be equipped for the application of live steam to be applied to the ice immediately same has been raised above surface.

SETTLING BASINS

The roofs of the settling basins in the Ottawa water purification plant are insulated with cork board, but notwithstanding this insulation, ice does form in extremely cold weather. Trouble from this source is avoided by emptying the settling basins before the ice thickness reaches the danger point, breaking the ice up and flushing it down the 54-inch drain. The ice bridges the settling basin from wall to wall and, to avoid the danger of injury to workmen on the floor of the settling basin from falling ice, the manholes in the roof are opened and the ice broken up as much as possible through the manholes before emptying.

SAND FILTERS

In the sand filters no trouble has been experienced from the action of frost, as in the Ottawa Plant the settled water conduits are between the filters and exterior walls. The comparatively high velocities in the settled water conduits prevents ice forming in the conduits themselves.

FILTERED WATER RESERVOIR

As the filtered water reservoir is located below the filters, and has, on three sides, the wash-water drain conduits between it and exterior walls, which are protected up to the highest water elevation of the reservoir by an earth ramp, we have experienced no difficulties from frost.

MAIN SUPPLY PIPES

Two 51-inch diameter steel pipes cross the channel of the Ottawa River between Lemieux Island and the Ontario mainland on a concrete bridge structure. These pipes are insulated with three 1-inch thick layers of hair felt, covered with heavy roofing felt, but, as an added precaution, heating units are maintained in the bridge during the period of extreme temperatures.

A new 48-inch steel cylinder concrete pipe line was installed during 1936. This line is carried across the river on a separate steel structure. This pipe is insulated with two 1½-inch thick layers of rock cork, applied over expanded metal and with the joints staggered. An air space is to be left between the pipe and the expanded metal, and a steam pipe is being placed in this air space, so that steam heat can be applied when necessary. Over the rock cork will be applied a ½-inch thick coating of weatherproof and plastic asbestos cement.

DISTRIBUTION SYSTEM

In the City of Ottawa the Distribution System is comprised of 250 miles of water mains ranging in size from 3-inches to 51-inches in diameter; 31,000 services; 1,950 fire hydrants and approximately 2,850 gate valves.

WATER MAINS

As all water mains were installed in former years with a covering of earth of 5-feet 6-inches, and in view of the fact that in recent years determinations have been made of frost penetration to depths in excess of 7-feet 6-inches, it will, therefore, be appreciated that the problem of maintaining the distribution system from injury by frost is indeed a serious one. These conditions are considerably more prevalent in recent years due to the excessive removal of snow from city streets which in former years, as an insulating medium, acted as a deterrent agent to frost penetration. All installations of water mains in recent years have provided for a minimum covering of 7-feet 6-inches.

Commencing at the latter part of January when the frost approaches the depth of the mains, it has been found necessary in certain sections of the city to carry out tests for running pressure of fire hydrants in order to determine the quantity of water available for fire extinguishment.

Where these tests show an abnormal drop in running pressures it is then the policy of the water department to utilize the services of one or more self-contained thawing machines for the purpose of introducing heat into the mains, and thereby melting any ice formations which have tended to cause a reduction in flow. In order to ensure definitely a circulation of the water from either side of the grid, control valves at opposite ends are temporarily closed and the flow established alternately from each direction.

This policy is definitely carried out daily after midnight and has been adopted to ensure a maximum supply of water throughout the distribution system.

When frost penetration reaches the elevation of the water mains, ice starts forming on the inner walls of the pipe. Apparently this ice formation disrupts the lime coating on the inside of the pipe, forcing some or all of it into the water stream, where it re-dissolves. Ottawa has recently adopted the practice of reducing considerably the lime dosage during that period over which ice could be expected on the pipe walls, and this practice has eliminated the presence of excess lime tastes in the water.

HYDRANT LATERALS AND FIRE SERVICES

Hydrant laterals and fire services in which there is seldom any movement in the water, have been insulated with hair felt and mineral wool covered with ready roofing and sealed with pitch to make them water proof which is absolutely essential for insulating purposes. Wherever possible, a service connection has been tapped to the hydrant lateral so that there will be a daily movement through the pipe and I strongly advocate the tapping of the fire mains to sprinkler systems immediately inside the building and connecting the domestic or commercial service under meter at this point.

FIRE HYDRANTS

The systematic inspection of fire hydrants in any municipality is a factor which should receive the utmost consideration from the authorities in charge and for this reason it is considered advisable to have men especially trained for this service. During the latter part of October all hydrants in the city are examined to make certain that they are in good working order. Any hydrant found with water left in it is pumped out and if a further examination still shows water, it is then lifted and repaired before being placed back in service. All caps on the hydrants are then loosened about one half turn as past experience has shown that if the caps are left tight it is very difficult to open them during the cold weather. This same group of men are then given separate districts in which they are responsible for all hydrants and regular examinations are made during the winter months, the districts being so arranged that all hydrants in the business section of the city are inspected daily while those in other locations are inspected twice each week. This work

requires the full time of eleven (11) men, each man being required to inspect approximately 180 hydrants excepting those in the business district where the number is reduced by one half.

GATE VALVES

As considerable difficulty has been encountered in the operation of the large valves during the extreme cold weather it has been found of great advantage to have these valves steamed at night and in the large valve chambers, controlling the main feeder pipes and where air valves are installed, electric heaters are placed and the air valves insulated. This practice has given the greatest satisfaction.

EMERGENCY SERVICE

In order to assure the immediate operation of all hydrants for fire purposes, a Water Works truck is equipped with a regular steam boiler which is constantly kept under pressure and responds to all fire calls. This service has been of the greatest assistance to the Fire Department because the man in charge of this work not only examines all hydrants in the vicinity of the fire which it might be necessary to use, but thaws out the fire hose and couplings which facilitates the work of the firemen.

THAWING OF WATER PIPES

Because electricity provides a more economical and quicker means of thawing frozen water pipes it has been finding great favour for this purpose in water departments during the past few years. Where proper equipment is available, such as a portable gasoline driven motor generator set, the problem of re-establishing flow in pipes which have become frozen has become a very minor one.

A current passing through an electrical conductor always generates heat. While this heat may not be noticeable due to dissipation, nevertheless heat is generated and the more current that is transmitted through a conductor the greater is the heating effect.

In the practice of thawing water pipes the temperature of the conductor will continue to rise, causing the melting of ice within the pipe.

In order to operate the distribution system efficiently, during the severest winter temperatures, the water works department has a fleet of five portable electric thawing machines which are used for thawing water mains, services, hydrants and valves. During an

average winter, these machines are called upon to thaw out approximately 900 water services, 30 water mains, 2,000 hydrants and 100 valves, and have given the greatest satisfaction in service, the average time for thawing an ordinary domestic service being anywhere from three to ten minutes and the average unit cost being $1.78.

LOCATING WATER MAINS

In addition to the thawing operations carried out by the use of these machines they may also be used to great advantage by a water department in conjunction with an induction coil to find the location of any water mains and services which are not definitely located in the records.

DETERMINATION OF FROST PENETRATION

In recent years the Department has been conducting a study of frost penetration in various soils in relation to snow covering.

To-date a considerable amount of data has been compiled and it is planned to continue this research study each winter by the insertion of thermometers in copper tubes at one foot intervals in certain valve chambers throughout the city.

A SIMPLIFIED METHOD OF IRON AND MANGANESE REMOVAL*

By D. L. Erickson[1] and N. T. Veatch, Jr.[2]

The City of Lincoln, Nebraska obtains the greater part of its domestic water supply from a series of wells located in the Platte River Valley about three miles northeast of the City of Ashland, Nebraska and about thirty miles northeast of the City of Lincoln. The wells are equipped with individual pumps which discharge through a common thirty-six inch cast iron force main into the iron and manganese removal plant which is located at Ashland. After treatment, the water is lifted into a storage or equalizing reservoir which has a capacity of three million gallons and is finally pumped to Lincoln through a twenty-six mile line of thirty-six inch cast iron pipe.

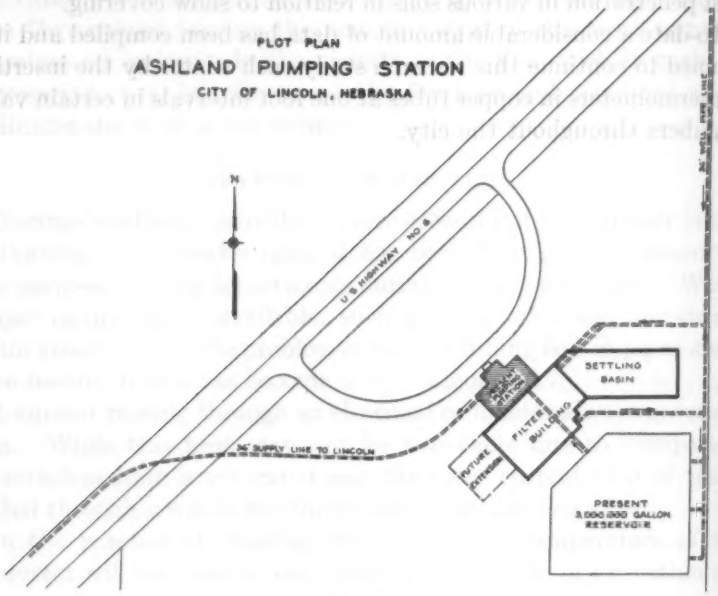


Fig. 1

* Presented at the Buffalo Convention, June, 1937.

[1] City Engineer, Lincoln, Nebraska.

[2] Of Black and Veatch, Consulting Engineers, Kansas City, Mo.

Prior to the design of this plant, careful preliminary studies of the then known methods of iron and manganese removal were made in a laboratory-size pilot plant which was operated for a period of eighteen months. A detailed description of these studies has been published in this Journal (**27**: 337 (1935)) and in order to show the problems involved, a brief outline of the information contained in the above mentioned article will be given here.

TABLE 1

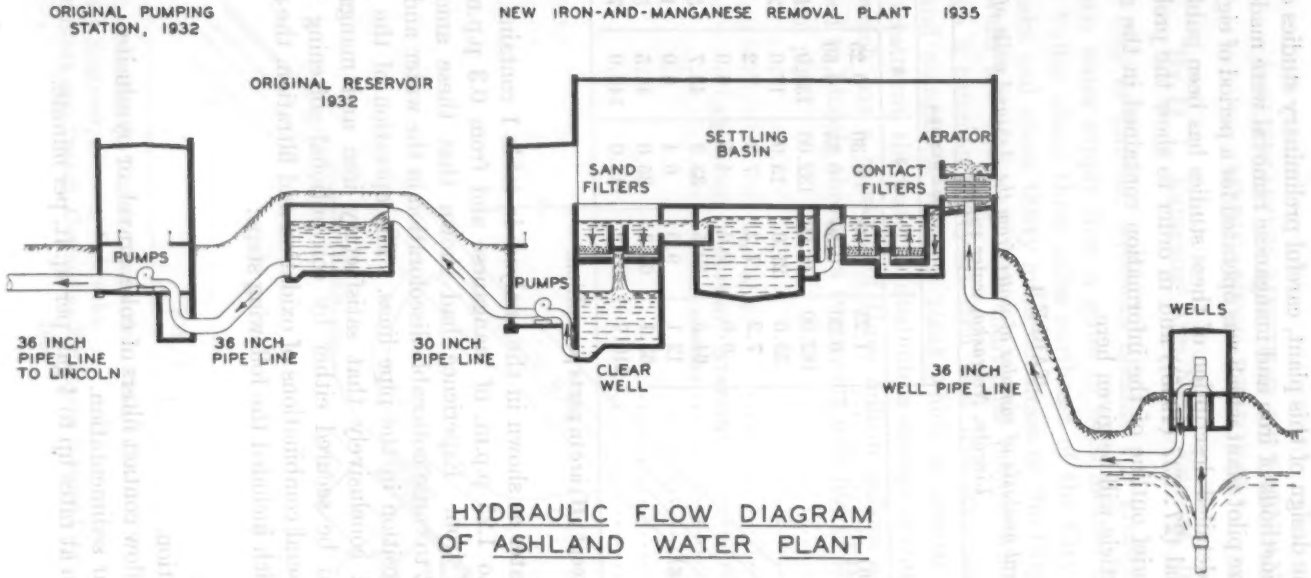
Partial mineral analysis of samples of water from the Ashland wells of the Lincoln, Nebraska, water supply

	WELL NUMBER				
	1	2	3	4	5
Manganese (Mn)	1.25	0.95	0.30	0.25	0.36
Iron (Fe)	0.30	0.30	0.55	0.60	0.10
Alkalinity	182.00	148.00	132.00	138.0	152.0
Free CO_2	35.0	21.0	13.0	17.0	25.0
pH	7.2	7.2	7.3	7.2	7.1
Chloride (Cl)	9.0	9.0	4.5	6.0	7.5
Calcium (Ca)	64.5	50.5	33.9	43.7	53.9
Magnesium (Mg)	12.1	9.0	6.4	8.0	10.3
Sulfate (SO_4)	63.1	65.3	35.0	44.5	53.9
Hardness	210.9	163.2	111.0	142.0	177.1

* Results (except pH) are in parts per million.

The raw water as shown in the analyses in table 1 contains from 0.25 p.p.m. to 1.25 p.p.m. of manganese and from 0.3 p.p.m. to 0.6 p.p.m. of iron. Experience had shown that these amounts were sufficient to cause noticeable discoloration in the water and appreciable deposition in the pipe lines. The operation of the pilot plant showed conclusively that satisfactory iron and manganese removal could be secured either by conventional softening with lime or by several combinations of oxidation and filtration, the most feasible of which included the following steps:

1. Aeration.
2. Chlorination.
3. Upward flow contact filters of coke, gravel, or pyrolusite.
4. Two hour sedimentation.
5. Filtration at rates up to 4 gal. per sq. ft. per minute.



HYDRAULIC FLOW DIAGRAM
OF ASHLAND WATER PLANT

CITY OF LINCOLN NEBRASKA OFFICE OF CITY ENGINEER

FIG. 2

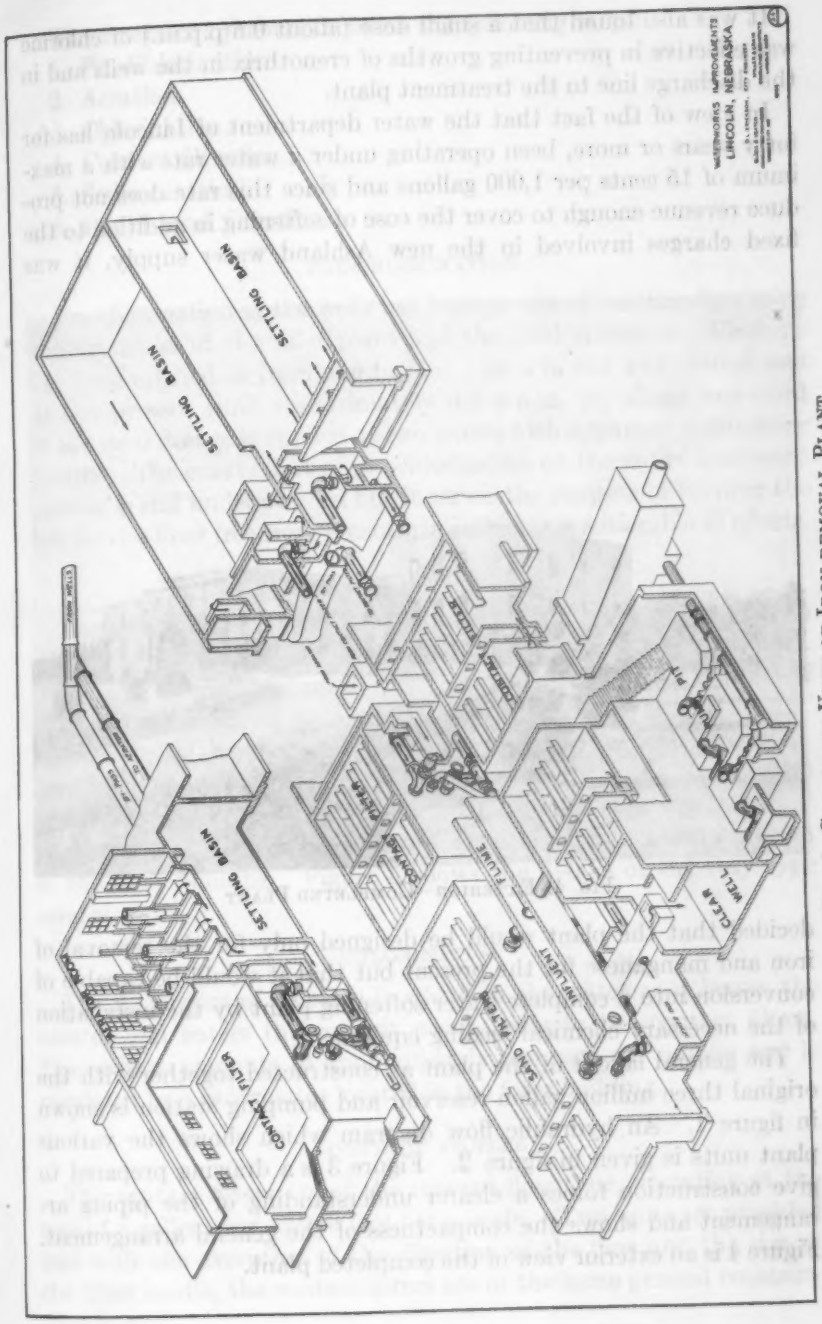


FIG. 3. GEOMETRIC VIEW OF IRON-REMOVAL PLANT

It was also found that a small dose (about 0.5 p.p.m.) of chlorine was effective in preventing growths of crenothrix in the wells and in the discharge line to the treatment plant.

In view of the fact that the water department of Lincoln has for forty years or more, been operating under a water rate with a maximum of 15 cents per 1,000 gallons and since this rate does not produce revenue enough to cover the cose of softening in addition to the fixed charges involved in the new Ashland water supply, it was

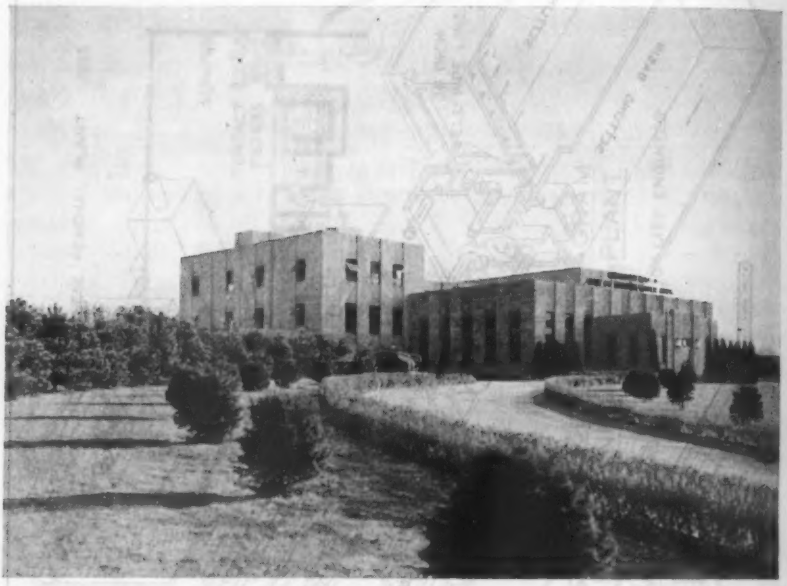


FIG. 4. EXTERIOR—COMPLETED PLANT

decided that the plant would be designed only for the removal of iron and manganese for the present but that it would be capable of conversion into a complete water softening plant by the installation of the necessary chemical feeding equipment.

The general layout of the plant as constructed together with the original three million gallon reservoir and pumping station is shown in figure 1. An hydraulic flow diagram which shows the various plant units is given in figure 2. Figure 3 is a drawing prepared to give construction forces a clearer understanding of the piping arrangement and shows the compactness of the general arrangement. Figure 4 is an exterior view of the completed plant.

The treatment process includes the following steps:

1. Pre-Chlorination.
2. Aeration.
3. Chlorination.
4. Contact filtration.
5. Sedimentation.
6. Rapid sand filtration.

PRE-CHLORINATION

Pro-chlorination at the wells has been practiced continually during the operation of the pilot plant and the final structure. Chlorine has been applied at from one to four points in the well system and at the present time approximately 0.5 p.p.m. or, about one-third of the total dosage is applied at two points with apparent satisfactory results. The exact effect of pre-chlorination on the entire treatment process is still undetermined but it serves the purpose of keeping the low service lines free from crenothrix and has no noticeable ill effects.

AERATION

The aerator consists of three parallel tiers of coke trays through which the water is allowed to flow downward from top to bottom. The inlets rise to the top of the tiers where the water is diffused through a perforated slate slab. The perforations are $\frac{11}{16}''$ x $1\frac{5}{8}''$ tapered drilled holes spaced 6″ center to center in both directions. The coke trays, four in number, are spaced 16″ apart (vertically) allowing the water a total drop of 6′–0″ to the collecting trough at the bottom. The entire structure is enclosed in a separate room of the filter building. Figure 5 shows the details of the tray type aerator.

CHLORINATION

The main dose of chlorine is added to the water as it leaves the aerator and enters the conduit which leads to the contact filters. This dosage amounts to approximately one part per million and is regulated by a chlorinator located in the filter building.

CONTACT FILTERS

The contact filters are of the upward flow type, operating at the rate of 8 gallons per square foot per minute. Two units are provided and with the exception of the direction of the flow and the size of the filter media, the contact filters are of the same general construc-

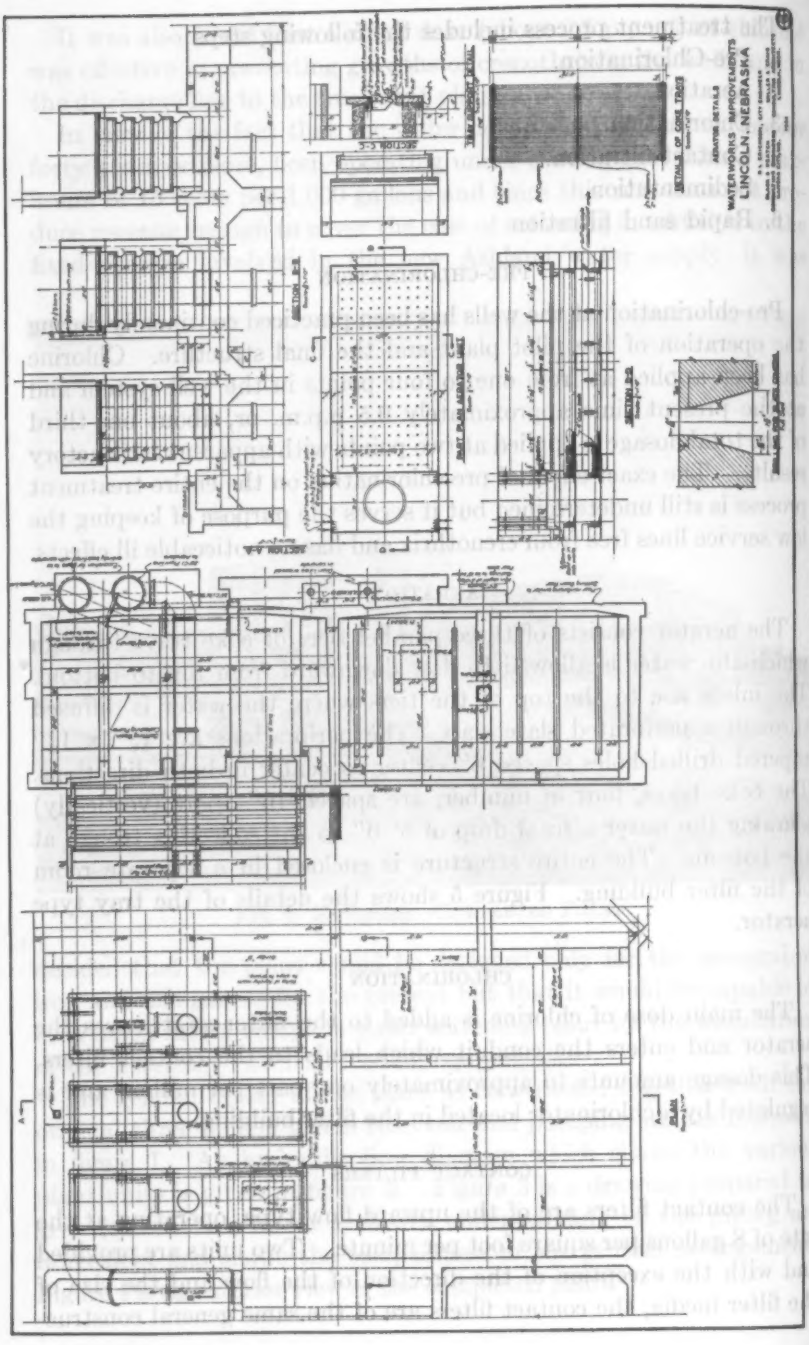


FIG. 5. AERATOR DETAILS

tion as the final sand filters. Whenever it is desired to go to complete water softening, the two contact filters can be converted into standard final sand filters by lowering the wash water troughs and making some minor piping changes to reverse the direction of flow. Provision is made for backwashing as in the standard sand filters.

The filter material in the contact units consists of $\frac{1}{4}$ inch gravel in uniform size. It was selected because the final results from the experiments previously referred to indicate that gravel is entirely suitable for the purpose.

SEDIMENTATION

Provision for sedimentation for a period of two hours, is provided in a covered basin, so located that the effluent from the contact filters may pass through it enroute to the final filters. The basin is constructed in two passes and the layout is predicated on the theory that if the city should ever desire to undertake softening by the chemical process, the basin, as constructed, can be equipped with flocculators and mechanical sludge removal equipment. By-pass piping is provided for cleaning the basin and at such times the effluent from the contact filters will go directly to the influent conduit of the sand filters.

FINAL FILTERS

Four filter units of the conventional water-wash type and designed for operation at a rate of 4 gallons per square foot per minute have been provided. At this rate the total plant capacity will be 12 M.G.D. or 3 M.G.D. per unit. The underdrain system consists of a series of 4-inch cast iron pipe laterals connected with a central concrete box which serves as an effluent manifold. The cast iron laterals have a series of $\frac{3}{8}$-inch holes drilled 6 inches on centers. The filter layer consists of 18 inches of graded gravel, on top of which is placed 2 feet of carefully graded sand. The wash water troughs are made of concrete. Figures 6 and 7 are interior views of the filter operating floor.

GENERAL

The plant includes a number of interesting details. In the first place the arrangement of the plant itself in relation to the original reservoir and pumping station, in order to utilize to best advantage the available space and to provide for attractive landscaping, is of particular interest. Considerable study was given to the matter of wash water supply, the studies including not only cost but the

FIG. 6. OPERATING FLOOR

FIG. 7. OVER FILTERS—OPERATING FLOOR

FIG. 8. WALKWAY IN PIPE GALLERY

FIG. 9. PIPE GALLERY

consideration of appearance. In view of the fact that the pumping station site is located on a transcontinental highway, the city had done considerable landscaping, and it was felt that a conventional steel outdoor tank would conflict with the desired effect. In order to produce a balanced structure architecturally, it proved desirable and economical to place the wash water tanks in the second story of one wing of the new structure and the chemical storage room in the second story of the other wing.

Another interesting feature of the plant was the pipe gallery arrangement, where a clear passageway is provided throughout the gallery in the space between the concrete influent channel and the concrete sewer. All piping and fittings are of comparatively short lengths and easily accessible for repair or replacement. Figures 8 and 9 are views showing arrangement of pipe gallery piping, conduits, etc.

OPERATING RESULTS

Figure 10 shows the manganese removal results during the operation of the completed plant during the past nineteen months. It will be noted that the manganese content of the influent varied from 0.5 to 0.8 p.p.m. with the exception of a short period in April, 1936, when it increased to 1.2 p.p.m. At first operation, the plant removed only about 40 per cent of the manganese, whereas today the plant removes 95 per cent of the manganese. From the very first, the plant has removed practically all of the iron.

Since the plant was started in operation, the removal of manganese has been constantly improving so that at present the plant effluent contains not more than 0.04 p.p.m. manganese and 0.02 p.p.m. iron.

Figure 10 also shows the amount of chlorine applied during the operating period and the corresponding residual chlorine in the plant effluent. It will be noted that the applied chlorine varies in general from 1.2 to 1.8 p.p.m., and that the residual chlorine in the plant effluent is usually below 0.5 p.p.m. As a matter of operating procedure, the amount of chlorine to add at the plant is determined by the chlorine residual of the plant effluent, which is held as nearly as possible to a maximum of 0.5 p.p.m.

At first, some difficulty was encountered in obtaining uniform results. At the end of one year's operation, it was discovered that improvement could be accomplished by re-arranging the location of the chlorinator outlets so as to obtain a more uniform distribution of chlorine in the flume below the aerator. As a result during the last six months of the operating period, the manganese residual has been usually less than 0.1 p.p.m.

When the plant was first put into operation, the time of washing the contact filters was arbitrarily set at once a week. It soon became apparent that the residual manganese in the effluent increased during the last one or two days of the contact filter run. The routine was then established of washing them every five days, which practice is

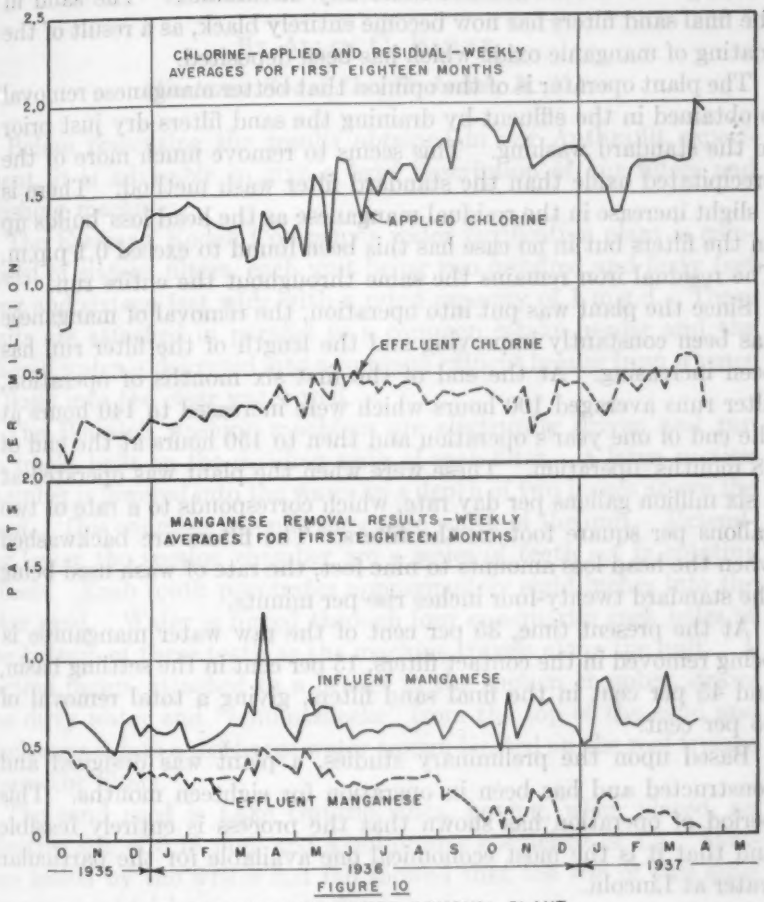


FIGURE 10

IRON AND MANGANESE REMOVAL PLANT AT ASHLAND, NEBRASKA

still being followed. This has given very satisfactory results. There is no indication of changes in the residual manganese that can be traced to the washing of the contact filters.

Recently, it was noted there were indications that the flow through the contact filters was not uniform over the whole unit. In an

attempt to loosen up the gravel, the units were washed with a stream of water from a fire hose. There is no present knowledge as to the effect of this washing on the manganese removal.

A heavy coat of manganic oxide has been built on the contact gravel, which apparently adheres so strongly to the gravel that the washing with a hose did not cause any disturbance. The sand in the final sand filters has now become entirely black, as a result of the coating of manganic oxide which has been deposited.

The plant operator is of the opinion that better manganese removal is obtained in the effluent by draining the sand filters dry just prior to the standard washing. This seems to remove much more of the precipitated oxide than the standard filter wash method. There is a slight increase in the residual manganese as the head loss builds up on the filters but in no case has this been found to exceed 0.1 p.p.m. The residual iron remains the same throughout the entire run.

Since the plant was put into operation, the removal of manganese has been constantly improving and the length of the filter run has been increasing. At the end of the first six months of operation, filter runs averaged 100 hours which were increased to 140 hours at the end of one year's operation and then to 150 hours at the end of 18 months' operation. These were when the plant was operated at a six million gallons per day rate, which corresponds to a rate of two gallons per square foot on the filters. The filters are backwashed when the head loss amounts to nine feet, the rate of wash used being the standard twenty-four inches rise per minute.

At the present time, 35 per cent of the raw water manganese is being removed in the contact filters, 15 per cent in the settling basin, and 45 per cent in the final sand filters, giving a total removal of 95 per cent.

Based upon the preliminary studies, a plant was designed and constructed and has been in operation for eighteen months. This period of operation has shown that the process is entirely feasible and that it is the most economical one available for the particular water at Lincoln.

The entire plant was constructed and equipped for a total of $225,000.00. It was constructed under the direct supervision of Mr. D. L. Erickson, City Engineer, Lincoln, Nebraska. The plant was designed by Black and Veatch Consulting Engineers, Kansas City, Missouri in conjunction with Miller and Craig, Consulting Architects, Lincoln, Nebraska.

USE OF ANTHRAFILT IN A SLOW SAND FILTER*

By Allen C. Bailey
(*Eastman Kodak Co., Rochester, N. Y.*)

Before presenting the results obtained in our Anthrafilt experiment, it is advisable to give a brief description of our filters and washing machines.

The Eastman Kodak Company's water purification plant is composed of sixteen filters, each unit being two hundred and forty feet long and sixteen feet wide with a rated capacity of 1 m.g.d. These units are attached in parallel to a common intake header and the filtered water is delivered into a common effluent header from whence it flows into the clear water well.

The Blaisdell washing machines are electrically driven and run on tracks built on the dividing walls of each filter. A large suction chamber is lowered into the water to a depth of two inches above the sand. This chamber extends the entire width of the unit. Extending below the suction chamber are a series of teeth set in rotating wheels. Each tooth penetrates approximately eight inches into the filter sand. Water is forced through four one-quarter inch holes at the bottom of these teeth as the machine travels along the unit. A suction pump, attached to a header in the suction chamber, draws the dirty water and "schmutzdecke" from the top of the sand and discharges it into a discharge water trough located on the roof trusses above the filters.

The sand used is Lake Ontario silica, having, when placed, an effective size of 0.18 mm. and a uniformity coefficient of 1.5. Samples tested by the writer last fall showed that the size of this sand has remained fairly constant to date.

In order to perform our experiment with Anthrafilt, we removed the top four inches of sand from one of our beds and replaced it with thoroughly washed Anthrafilt, having an effective size between 0.40 and 0.45 mm., and a uniformity coefficient of 1.4. You will notice

* Presented at the Buffalo convention, June 10, 1937.

that each grain of Anthrafilt is approximately twice the size of each grain of sand. It was possible to use this size because of the fact that each grain of Anthrafilt weighs approximately one-half as much as a grain of sand of the same size; therefore, each grain of Anthrafilt that we put on our bed is approximately the same weight as each grain of our sand. In reality, we put a roughing filter on top of the regular sand filter.

Before using Anthrafilt on our filters we wanted to determine the following:

(1) Would the Anthrafilt and sand mix due to the high agitation of the filtering media, caused by our method of cleaning?
(2) Would the washing machine pull the Anthrafilt off the bed at the same time that it pulls the schmutzdecke and dirty water?
(3) Would the amount of washing per bed be decreased per million gallons output?
(4) Would the effluent obtained during high turbidity periods meet the standards which we must keep in our water purification?
(5) Would the chemical components of the effluent be changed because of the use of a coal filter instead of a sand filter?

Please bear in mind that this filter plant is used to supply water for special industrial purposes only; and that we do not use any chemicals whatever in the treatment, but take the raw water from Lake Ontario and pump it directly on to our filters.

Now, to go back to the purposes for which this experiment was carried out. In order to determine the possibility of mixing, a small test filter was built in our laboratory, and as nearly as possible the scrubbing action of the washing machine was duplicated. Sand and Anthrafilt were placed in this filter in the same manner that it would be on the filter and it was washed with the small test washer. The results showed that the Anthrafilt and sand would stay as placed, with a definite line of demarcation.

When the Anthrafilt was placed on the filter and cleaned at our regular washing depth, the results of the laboratory experiment were verified as far as we could determine. We did not want to drain the bed and dig test holes as this would spoil our test.

We next wanted to determine whether it would mix when we put the longer teeth in the washer and washed the bed at a greater depth, which we do at least once a year. We attached a four-inch capped projection on each of our teeth, with holes in the bottom from which the water would be forced, and washed the filter at this depth. At

the end of two weeks the filtering material was inspected and it was found that there was considerable mixing of the same and Anthrafilt at this greater washing depth. This mixing occurred to a maximum depth of eleven inches.

In determining the amount of loss due to the suction of the machine lifting the Anthrafilt from the unit, it was washed several times, each time bringing the suction chamber a little closer to the two-inch mark. Samples of the discharge water were taken at regular intervals and checked to find the amount of Anthrafilt in each sample. It was found that very fine particles were drawn off during the first few washings, but afterwards, at the two-inch level, this stopped until no dust was found. At all these depths no large particles of Anthrafilt were found in the wash water.

It is necessary that we wash a filter at least twice in order to get a million gallons of water through it in twenty-four hours. However, during a test period, we found that if we washed our Anthrafilt unit one-third as often as our regular units, we would obtain an equivalent output. If we washed it as many times as one of our regular units, the output was approximately thirty percent higher. It takes forty-five minutes to wash a bed, which means that for every million gallons output for twenty-four hours each unit is in service twenty-two and a half hours. By cutting down the washing, the gallon-per-minute rate of the Anthrafilt unit has been decreased; therefore, it should make it more efficient because we found that the higher the rate of filtration the higher the turbidity of the effluent. This was not the case, as we found that the rate of filtration of our Anthrafilt unit had no effect upon the turbidity of the effluent.

The sand filter will take an incoming turbidity of 150 to 200 p.p.m. and give an effluent turbidity between 2 and 3 when we are pumping 16 million gallons per day, which is the maximum rate the filters will treat water with a temperature under forty degrees. Tests on our Anthrafilt effluent showed that this was still true.

In obtaining samples of the effluent from the Anthrafilt unit and comparing them with samples taken from one of our sand filters, Mr. G. W. Moore, District Sanitary Engineer, kindly consented to have the State Department of Health in Albany make tests for us. The results of a series of tests taken with the turbudity of the influent at 10 p.p.m. show:

(1) The effluent of the Anthrafilt filter is somewhat softer than the effluent from the sand filter.

(2) The sand filter was somewhat more effective than the Anthrafilt filter in the removal of organic matter, as was indicated by the reduction in oxygen consumed value and albuminoid ammonia content.

(3) The sand filter was somewhat more effective in reducing the color than was the Anthrafilt unit. However, both showed an increase in the degree of removal of organic matter as their time in service increased.

TABLE I

Comparison between the effluents of the Anthrafilt filter and a sand filter

Figures represent parts per million, unless otherwise noted

	RAW WATER	SAND FILTER	ANTHRAFILT FILTER
Color	12	3	5
Turbidity	10	trace	trace
Odor			
cold	1 Veg.	1 Veg.	1 Veg.
hot	1	1	1
Iron	0.5	0.1	0.1
Ammonia Nitrogen			
free	0.038	0.002	0.004
albuminoid	0.246	0.148	0.006
Nitrites	0.009	0.004	0.003
Nitrates	0.16	0.3	0.3
Oxygen consumed	2.9	2.4	2.2
Chlorides	13.8	14.0	13.4
Hardness (total)	124.0	126.0	114.0
Alkalinity	95	95	95
pH	7.9	7.8	7.7
Bacteria per cc. 24 hrs. at 37°C.	600	2	2

The last part of the analysis made is probably the most important as far as you gentlemen are concerned. This is not important at Kodak Park; that is, the colifórm organism count, as it is shown in the raw water, the effluent from the Anthrafilt filter, and the effluent from the sand filter. In the following table "plus" designates coliform bacteria present and "minus" coliform bacteria absent. This will give you an idea of the efficiency of the filters, as well as the condition of the raw water.

This shows that without any chemical pre-treatment there is very little difference in the effectiveness of the two types of filters.

From these tables you will see that the efficiency of both types of filtering material in the removal of foreign particles is practically the same; also that there is little difference in the chemical content of the effluent.

TABLE II

	RAW WATER		SAND		ANTHRAFILT	
	Plus	Minus	Plus	Minus	Plus	Minus
10 cc's (5v)	5	0	2	3	5	0
1cc (1v)	1	0	1	0	1	0
1/10cc (1v)	1	0	0	1	0	1

TABLE III

Results obtained on the day of highest turbidity this spring

Figures represent parts per million, unless otherwise noted

	RAW WATER	SAND FILTER	ANTHRAFILT FILTER
Color	10	2	5
Turbidity	80	7	Trace
Odor			
cold	1 Aromatic	2 Aromat.	1 Veg.
hot	1 Aromatic	2 Aromat.	1 Veg.
Iron	1.16	0.2	0.003
Ammonia Nitrogen			
free	0.030	0.002	0.004
albuminoid	0.140	0.042	0.044
Nitrites	0.006	0.001	0.001
Nitrates	0.24	0.3	0.3
Oxygen consumed	3.3	2.3	2.4
Chlorides	13.4	14.2	11.0
Hardness Total	120.0	114.0	122.0
Alkalinity	93.0	87.0	83.0
pH	7.7	7.7	7.7

You will recall that at the beginning of this paper it was stated that, at first, when we washed the comparative units the same number of times we obtained approximately 30 per cent greater output with the Anthrafilt filter. This increased output has gradually declined over a period of about five months until on the worst day this spring the output was only eleven percent greater. Overnight the yield of these units changed and the output of the sand filter became two

percent higher than the Anthrafilt filter. This difference has gradually become greater until at present the sand is yielding approximately thirty percent more than the Anthrafilt. We are continuing the tests and are trying to determine the reason for this change.

The following is the method we used to determine whether the chemical constituents of the water would change because of the use of Anthrafilt. Five pounds of Anthrafilt, as it came from the mine, was washed in a gallon of our filtered water for a week. This water was drawn off and tested. New water was placed on the Anthrafilt and it was washed for a week. This water was drawn off and tested. A third gallon of water was placed on the Anthrafilt for a week and tested. The results were as follows:

The total solids increased with the first wash and came back to normal with the second wash and then remained the same. The volatile and organic matter did the same. The silica decreased one-half. The iron and aluminum oxides increased three times after the first wash and came back to normal after the third wash. The calcium oxides decreased with continual Anthrafilt washing. The magnesium oxides followed in the same line as the total solids. The sulphur content had tripled at the end of the first wash, but came back to normal at the end of the third wash. The temporary hardness decreased twenty-five percent.

The writer wishes to take this opportunity to thank Mr. Moore for his aid in obtaining chemical and bacteriological analyses of the water and Col. Brown and Mr. Cather of the Eastman Kodak Company for their permission to present this paper.

Discussion by H. G. TURNER: Mr. Bailey is to be complimented on the presentation of a paper which deals with a problem that is entirely new. He has listed five questions to which he desired answers and his data show that he has answered these questions conclusively.

In its broader aspects the problem is one of increasing the capacity of a slow sand filter without building new filters or making changes other than in the filter medium.

Mr. Bailey has shown that the four inch top dressing of Anthrafilt became mixed with the sand; he has shown that Anthrafilt is strong enough to withstand the rough cleaning action without breaking down; he has shown that Anthrafilt is stable chemically and contributes no soluble salts to the effluent. One of the most interesting points, however, is the demonstration that the quality of the effluent

has not been impaired in spite of the fact that the upper 11 inches is no longer .18 mm. sand. This would indicate that a layer of at least 11 inches of Anthrafilt could be used without risking quality of effluent. The fact that the combination filter is now running behind the all sand units probably means that the turbid matter has finally penetrated to a point below the reach of the cleaning teeth.

Whether the Anthrafilt would have remained on top of the sand had it been just less then twice the size of the sand grains is an open question. If Anthrafilt of such size would remain on top it certainly would be an effective way of increasing plant capacity.

The work that Mr. Bailey has done makes it seem reasonable that an all Anthrafilt unit of material having an effective size of about 0.45 mm. would double the capacity of his filters. If a 10 inch layer of 0.18 mm. sand will give a high quality effluent as seems to be the case here, a 20 inch layer of 0.45 mm. Anthrafilt should give the same quality effluent; for it is well established that the deeper the bed, the coarser the filter medium that can be used. It is also well established that Anthrafilt is a more effective medium than much finer rounded sand.

It is hoped that Mr. Bailey will continue his interesting experiments.

TREATMENT OF COLORED AND CORROSIVE WATERS*

By Norman J. Howard

(*Director, Filtration Plant Laboratory, Toronto, Ont.*)

This paper will briefly discuss some of the methods of treatment of colored and corrosive waters and will be presented, as far as possible, in non-technical language. The subject is so extensive that only the essential features can be discussed. Throughout the country, particularly in Northern Ontario and Quebec, the color and nature of many of the water supplies call for treatment, which fortunately, due to the mining development, is being increasingly employed.

Pure water has a pale blue color which rapidly undergoes color changes after deposition on the soil. The degree of color depends upon rainfall, temperature, sunlight and the nature of the material the water contacts. Much color is produced by decayed wood, leaves, peat, minerals in solution and by the disintegration of organic matter. The latter is chiefly brought about by combined chemical and biological action on material containing water-soluble substances, the color being readily taken up by the water mostly in the form of colloidal suspension. Such color can be described as being ultramicroscopic and cannot be filtered out without some kind of chemical treatment. It has been demonstrated that most of the colloidal color carries negative charges. This explains the reaction which occurs when certain coagulating chemicals carrying positive charges are employed for treatment. Inasmuch as the ionic theory of reaction involving the term hydrogen-ion concentration is referred to, it might be well to define just what this means. One of the most simple and expressive definitions was given some years ago by Green of Little Falls, N. J., who said "it is the measurement of a minute amount of hydrogen which is present in the ionic state due to electrolytic dissociation." The relationship of hydrogen ion determination to color removal is in the determination, if possible, of the optimum

* Presented before the Canadian Section, April, 1937.

point of effective coagulation known as the isoelectric point. This can and must be determined in the laboratory before a treatment plant is designed.

One condition of great importance which should be stressed, is that there is no cure-all or set rule for the treatment of colored waters. What is effective in one supply is totally ineffective in another. Color can be reduced by storage in open reservoirs due to the action of sunlight which has a bleaching effect. Filtration without the use of chemicals, notably in the slow sand system, has been found to remove certain types of color sometimes associated with iron by as much as 25 per cent. Unless the water is given some period of coagulation, pressure filters do not effectively remove color, with the possible exception of the Candy filter. It differs from all other types. The Candy filter contains three sections,—a pre-filter containing coarse filtering material; the oxidizing filter which contains oxydite or polarite (both commercial products); and the final filter containing fine sand. The organic matter and color, either in solution or suspension, contained in the water is largely absorbed by the oxidizing reagent. The use of this type of filter in England for dealing with ferruginous waters has been very successful.

By far the most common method of treatment is by the use of chemicals, but the difficulties experienced over a wide range of colored waters tend to emphasize the importance of determining not only the correct method of mixing, settling and the most suitable and economical reagent to use, but to make sure that the finished product will be non-corrosive and will not take up color again as a result of corrective treatment. Chlorine alone will blanch certain types of color if applied in sufficient amount, and it is perhaps fortunate that such types of water usually have a high chlorine demand. Brief reference to the chemicals used for coagulation of colored waters may be of interest. Alumina sulphate (commonly known as filter alum, containing approximately 17 per cent of water-soluble alumina) is most widely used as a coagulant with or without lime and soda ash. Sodium aluminate is a commercial product made by mixing alum with caustic soda. It may be used alone or with ordinary filter alum or ferrous sulphate. Sodium aluminate is very soluble over a wide pH range and is more effective than alum in very cold water. It is however more costly. Lime (generally known as quicklime) is used with alum and ferrous sulphate. It is used both for softening and for correction of corrosion. Quicklime must be carefully mixed

with water, before use, to convert it into calcium hydroxide. Hydrated lime is commonly used for the same purposes as quicklime but costs more. Soda ash is anhydrous sodium carbonate and should contain 98 per cent of pure sodium carbonate. It can be used with filter alum and does not increase the permanent hardness of the water. It is frequently used for prevention of corrosion, and is considered preferable to lime due to the fact that it is easier to handle and causes no after-precipitation in the distribution system. Its cost is considerably higher than lime. Ferrous sulphate (commonly known as copperas) is often used in conjunction with lime, chiefly for hard turbid waters. Sugar sulphate of iron is ferrous sulphate in purer form. Chlorinated copperas is being used in increasing quantities and is made by treating ferrous sulphate with chlorine in the ratio of 8 of iron to 1 of chlorine. This oxidation process converts it into ferric sulphate. It can be used singly or it may follow alum and lime treatment. It has been found to be particularly effective in removing color from swamp water. Ferric chloride is not extensively used in water treatment possibly due to its cost and corrosiveness. It is supplied in solution or as a hydrated or anhydrous salt.

Before treatment is commenced it is essential to determine the nature of the color and the pH reaction. With these details known, tests should be made to find out the optimum point of coagulation with different kinds of reagents; whether agitation of any kind is necessary to improve floc formation; and, to make sure that the floc has taken up the color. Next it is important to study the nature of the floc and to determine the most suitable velocity at which the flocculated water can pass through the sedimentation basins without breaking up the floc. In pre-conditioning water to secure the greatest color removal with maximum settlement of floc in the coagulating basins these studies are imperative otherwise we may have periodic troubles at the plant involving the occasional passage of colored and opalescent water, short filter runs and red water in the distribution system. In soft waters with moderate color and little iron, the optimum coagulating pH range is often between 5.4-5.5 and with soft but highly colored waters a much lower figure of 4.5 has been noted. To secure the most stable floc it is sometimes necessary to alter slightly the natural pH value by the cautious addition of an acid or an alkali. On the other hand a satisfactory floc can often be secured on soft water without altering the reaction.

If final correction has to be made for the prevention of corrosion, it is better to leave this until after filtration (particularly where lime is employed) as lime may again bind the color if it has not been completely adsorbed by the floc. Highly colored water derived from swamps or peaty soils, having a pH under 5, can be treated with alum, sodium aluminate or chlorinated copperas, the latter substance possibly having proved most successful. Dual treatment has been employed for this type of water using preliminary coagulation by means of chlorinated copperas followed by an alkaline coagulant. One great advantage of chlorinated copperas is that effective coagulation can be achieved over a far greater pH range than with the use of alum. With soft colored waters containing iron we may have a more difficult problem to handle and numerous reagents may have to be tried. Ferric chloride has been used with some success but needs very careful control. There is a critical optimum pH figure above which colloidal iron as ferric hydroxide may pass the filters. Ferric floc does not however dissolve at higher pH values as may alum floc. Other advantages of ferric chloride are that smaller doses can be used with rapid floc precipitation, reduced retention period in sedimentation basins and complete removal of color. One should remember, however, that the suitability of ferric chloride must be first demonstrated. In hard colored waters sometimes containing iron, several coagulants can be used including ferrous sulphate, lime and alum. All are frequently used in split treatment processes. Prechlorination of water prior to coagulation has been found useful in treating all kinds of colored water. Lime and chlorine or calcium hypochlorite have been effectively used in hard colored water containing iron, but there is an optimum figure and a distinct pH range where lime and chlorine react with iron, the water usually being highly alkaline. Lime and iron floc formation are most effective when the pH is 9.4 or higher. Providing there is no residual manganese, potassium permanganate as an oxidizing reagent followed by alum treatment has been successfully employed in the treatment of hard ferruginous waters. Removal of iron, chiefly from well supplies, by aeration methods followed by sand filtration is now generally employed. The use of zeolites for iron removal may increase in the near future.

The chief points governing color removal are the production of a stable adsorptive floc which will settle rapidly, will not break up, will not redissolve nor pass the filters. Experience in the past 25

years has shown that with careful plant control such a floc can be secured. In a majority of soft colored waters, it is necessary to correct the final reaction of the water to prevent corrosion in the distribution system. Both lime and soda ash can be employed. While it has been customary to leave the pH figure at 7.5–8, modern tendencies are to maintain the final figure at approximately 9.5. Standard practice is to secure a color of not greater than 20 in the finished product. A more desirable figure is 15 as above that color will have a tendency to show on a white table cover. Some color largely due to humins, occasionally returns in the distribution system due to reaction when contacting metallic iron. This is said to act as a catalytic agent and cause precipitation of a brown organic substance. If the water has been properly treated secondary color should not appear in the distribution system.

The effective treatment of colored water is one of the most severe problems in water purification, due in part to unforeseen and obscure conditions and to changes that occasionally occur in the raw water. Modern scientific treatment has solved almost all problems normally encountered in everyday practice. However, only close laboratory control can catch rapid changes in quality which may completely unbalance established treatment.

TREATMENT OF COLORED AND CORROSIVE WATER AT OTTAWA, ONTARIO*

By H. P. Stockwell

(*Chemical Engineer, Water Purification Plant, Ottawa*)

In a previous paper in this Journal (29, 1088 (1933)), an outline was given of the method of treatment of the Ottawa river water at the city of Ottawa water purification plant and some experiences and difficulties of the first year of operation were discussed. It is now five years since this plant was completed and operating and control methods are more firmly established on a routine basis, as will be described in the present paper.

The problem is chiefly one of color removal, the processes involved consisting of coagulation followed by settling, rapid sand filtration, corrective treatment with lime and sterilization with chlorine. The source of supply is the Ottawa river, an ample supply of soft colored water of the following characteristics:—pH, 6.9 to 7.4; color, 40 to 80; turbidity, 7 to 11 (except for about two weeks during the spring run-off when this increases to as much as 100 p.p.m.); alkalinity, 15 to 38 p.p.m.; and total hardness, 35 to 70 p.p.m.

The coagulant used is alum, the dosage varying from $2\frac{1}{8}$ to $2\frac{3}{4}$ grains per Imperial gallon, depending upon the raw water conditions. A minimum mixing time of 40 minutes and a minimum settling time of 3 hours and 20 minutes is allowed, the average time for each being twice the minimum. After settling, the water passes through rapid sand filters designed to pass 108 million (Imperial) gallons per acre per day, the average being about one-half this standard rate. This treatment reduces the color of the water after filtration to about 3; and, although the natural alkalinity of the raw water is comparatively low, residual alumina is at a minimum, averaging not more than 0.10 to 0.15 p.p.m. The pH of the filter effluent varies from 5.5 to 6.1. This acidity is corrected by the addition of lime before the water is pumped to the city.

*Presented before the Canadian Section, April, 1937.

The optimum alum dosage can be determined roughly by laboratory coagulation tests. Our experience is that a given dosage of alum shows better results in the plant than in the laboratory test, the difference representing a saving of about $\frac{1}{8}$ grain per gallon of alum. We formerly placed great emphasis on the optimum pH condition as the control for flocculation but now are inclined to regard the alkalinity of the raw water as the controlling factor in setting the correct dosage. This represents more a change in viewpoint than in operating conditions, but results in small savings of alum when alkalinity is near the maximum, where a small change in dosage causes little change in the resultant pH. Another useful control of coagulation is the *o*-tolidine test for residual chlorine which indicates changes in the small amount of organic coloring matter remaining in the filter effluent. This test responds to over-treatment as well as under-treatment and when considered with the alkalinity aids in determining the best possible dosage of coagulant.

The yearly consumption of alum in this plant amounts to approximately 1,200 tons and represents an expenditure of over $34,000. This is about 28 percent of all alum used in Canada for municipal water supply treatment. The cost per ton has increased about 20 percent during the past five years. This has directed attention to the possibility of using other coagulants. Ferric chloride and ferric sulphate give good results but the dosage required is slightly higher than with alum and the optimum pH value is about 4.5, requiring more lime for correction of acidity than when alum is used. If the lime is added before removal of the floc about 50 percent of the original color returns to the water; although flocculation is improved as is shown by reduction of the dissolved iron content. This and many other experiments tend to show the great difficulty of removing color with economical dosages of coagulant under alkaline conditions although this would be very desirable since it would reduce added hardness and allow sand and other insolubles from the lime to settle with the floc.

During the late summer the Ottawa water reaches a maximum temperature of about 75 degrees Fahr., and decomposition of organic debris contained in the sludge in the settling basins takes place. This would cause an undesirable odor in the plant and unpleasant taste in the water supply. Therefore, during the summer season, the settling basins are cleaned out every three weeks instead of six weeks as is our ordinary procedure. During the month of August a

dosage of 0.05 g.p.g. of activated carbon is added before flocculation and successfully controls this condition. For this treatment we require a very finely divided carbon to allow good distribution with the floc. Results were not satisfactory when carbon was applied at the filters and the filter runs were reduced by 30 per cent. Decomposition also takes place in sludge deposited in the settled water conduits leading to the filters and these also have to be cleaned periodically.

The filters contain 34 inches of Cape Cod sand of 0.47 mm. effective size and 1.39 uniformity coefficient, resting on 20 inches of graded gravel which ranges from $\frac{1}{16}$ to $1\frac{1}{2}$ inches in size. The time between backwashes varies from 60 to 120 hours, the end of the run being determined by increase in the color of the effluent to 5. The floc may be considered as penetrating down through the sand at a very slow rate and finally appearing in the effluent as is indicated by the rather sudden increase in color. A very useful control of the backwash process consists of an experimental filter containing the same depths of sand and gravel as the plant filters and fitted with a plate glass front. This apparatus enables the correct rate of backwash to be determined for any water temperature. It is also useful to demonstrate to the many organized groups of visitors at the plant the distributing effect of the gravel, the expansion of the sand, and the scrubbing action of the backwash water. By increasing the rate of backwash during the summer months mud balls have been kept at a minimum. The filters are treated twice a year with chloramine applied in the backwash water and retained in the filter for 24 hours to eliminate any possible undesirable bacteriological condition.

The clear well has a capacity of 6 million gallons, and, being the only reserve supply of filtered water, is kept full at all times by an automatic rate control system. The rate of flow throughout the purification process at any time is thus determined by the withdrawal from the distribution system. The construction of a second outlet this past winter afforded, for the first time, an opportunity to examine the condition of the clear well. Except for a slight coating on the walls, little or no sludge deposit was found.

As has been already stated, the filtered water in the clear well has a pH of from 5.5 to 6.1. This would be quite corrosive to iron piping and requires corrective treatment with lime before it is pumped to the distribution system. The water is treated with sufficient lime to convert all free carbon dioxide to calcium bicarbonate and a small

excess of lime is added to supersaturate it slightly with the very slightly soluble calcium monocarbonate. This is in accordance with the theory that this will cause the deposition of a protective coating on all piping. The lime treatment is controlled by pH determinations, the required pH being 0.2 unit higher than the solubility equilibrium pH as determined by the marble test. A sample of the treated water is placed with marble chips in a tightly stoppered bottle and then suspended for several days in one of the settling basins to maintain it at the correct temperature conditions. The pH of the solution, which is in equilibrium with the marble, is then determined. The correct lime dosage varies from 0.60 to 1.00 g.p.g. as quicklime and the pH of the plant effluent from 8.4 to 9.1.

As the hydrated lime suspension is added at a point just before the water is pumped to the distribution system, a high quality of quicklime must be furnished to the slaking and proportioning apparatus. It is quite necessary that sand and silica content be low. The present supply, which is produced locally, has less than 1 per cent of siliceous material and the available calcium oxide content approximates 93 per cent. We much prefer a wood burned lime as this slakes easier when using ice cold water in the slaker.

A peculiar situation has developed in recent years because of the extensive removal of snow from the city streets. This protection having been removed, frost penetrates during severe winter weather to a greater depth than formerly, resulting in ice formation on the inside surface of mains and in some cases complete freezing with destruction of the pipe. These mains were laid before the days of winter motor traffic, some before the beginnings of the automotive era, consequently when such frozen mains are relaid they are lowered to a depth of 8 feet, which is considered sufficient to meet the new conditions. During this extreme weather tastes of an earthy nature develop in the distribution system which are undoubtedly due in part to disruption of deposits on the inner surface of the mains by frost. We have now adopted the procedure of adjusting the lime treatment to give a pH below the solubility equilibrium value for the period from January to March inclusive, thus undertreating with lime during that time.

Red water is met with only at the hot water tap and appears only when the heating method allows temperatures at or near the boiling point to be reached when the lime treatment cannot protect against the violent surging which must take place under those conditions.

If an electric heater is employed, a thermostat placed on the hot-water tank and set to cut out at 160 degrees Fahr., is the best preventive. When the water is heated by a coil in the furnace this should be set well above the body of the fire. In extreme cases we recommend the replacement of all metal parts and piping by copper, brass or other resistant metal.

The final treatment in the purification process is sterilization with chlorine. The dosage varies from 3 to 5 lbs. per million gallons and is such as will give a residual chlorine content after 15 minutes contact of from 0.05 to 0.15 p.p.m. by the *o*-tolidine test. Bacteriological tests are made daily on two groups of samples by the local branch laboratory of the Department of Health of Ontario. One group concerns plant control only and consists of samples of raw water and filter effluent. The samples taken from the filters have shown over a period of 5 years that coagulation with alum followed by rapid sand filtration and without chlorine treatment is 100 per cent effective in the removal of coliform bacteria. The second group of samples are taken at various points throughout the city and have shown the public water supply to be bacteriologically of "A" quality at all times.

CORRELATION OF BACTERIAL POLLUTION WITH WATERSHED POPULATION*

By E. Sherman Chase

(*Partner, Metcalf & Eddy, Boston*)

This paper constitutes an attempt to answer the following question, "Is there any correlation between the results of bacterial examinations of surface waters and the populations resident upon the tributary drainage areas?"

From the public health standpoint, the dangerous organisms in water supplies are those pathogenic bacteria which may occur in the excretal discharges of human beings. The possible occurrence of such organisms is ordinarily believed to be indicated by the presence of the coliform group and routine bacterial examinations always include tests therefor. If there is a correlation between actual known human pollution and bacterial analyses, the test for the presence of these organisms should afford the best basis for comparison.

Although routine analyses of many public water supplies have been carried out in recent years, there has been published a limited amount only of accurate data upon watershed conditions. Furthermore, in some cases where watershed conditions are known with reasonable detail, analytical data are limited. For the purpose of this study, the data collected by the United States Public Health Service, in its investigations of the pollution of the Ohio, Illinois and Upper Mississippi rivers, have been used. (Public Health Bulletins No. 143, 171 and 203.) These data have the advantage of having been obtained by one agency with a corresponding uniformity of method and accuracy. The data used have been those relating to

* Presented at the Buffalo convention, June 10, 1937.

Editors Note—The term "coliform" is used in this paper in accordance with current recommended practice instead of the terms "B. Coli." or "coli-aerogenes group." The coliform group of organisms, when present, is demonstrated by the "complete" test, standard since 1917 and used by the U.S. P.H.S. in the research to which reference is made by the author of this paper.

certain of the several tributaries of the main streams in order to avoid streams with large centers of population on their banks. This selection results in limiting the study to streams subject to direct pollution from comparatively small municipalities and with moderate density of population per square mile.

TABLE 1

Drainage Areas, Populations and Coliform organisms

STREAM	DRAINAGE AREA SQ. MI.	POPULATION PER SQ. MI.		COSECS PER SQ. MI.
		Total	Sewered	
Ohio River Basin, (August–October, 1914)				
Licking	3,651	49.50	2.60	94
Kentucky	7,059	52.10	3.47	84
Cumberland	17,936	50.50	4.86	5
Tennessee	40,608	46.30	4.25	2
Illinois River Basin, (August–October, 1921)				
Kankakee	5,297	42.20	9.13	5
Fox	2,580	81.80	33.10	11
Vermillion	1,261	51.50	10.45	22
Mackinaw	1,174	32.80	2.28	129
Spoon	1,812	55.80	10.72	47
Sangamon	5,332	68.20	21.50	40
Crooked Creek	1,349	37.70	3.21	230
Macoupin Creek	944	43.75	5.76	44
Mississippi River Basin, (August–October, 1926)				
Mississippi above Minneapolis	19,440	22.75	3.95	2
Minnesota	16,750	22.70	4.49	2
St. Croix	7,610	21.30	2.54	35
Cannon	1,520	39.60	14.60	3
Chippewa	9,600	24.30	4.49	34
Zumbro	1,420	38.90	12.55	20

In order to avoid the undue influence of factors other than population, an attempt has been made to use analytical results obtained under as nearly the same conditions in each case. In addition, the results for coliform organisms are expressed in "Cosecs" units, which may be defined as the number of such bacteria per cubic centimeter multiplied by the discharge in cubic feet per second. The use of

Cosecs, which are units of quantity, takes care of the effect of dilution. Inasmuch as stream flow conditions are likely to be more uniform in the late summer and early fall months, the bacterial results for the months of August, September and October have been selected for the attempted correlation. The preceding tabulation, table 1, gives the significant data for the eighteen streams taken under consideration.

If there were a clearly defined relation between the quantity of coliform bacteria and the density of population upon the watershed,

TABLE 2

Drainage Areas, Populations and Coliform bacteria

STREAM	POPULATION PER SQ. MI. SEWERED	COSECS PER SQ. MI.
Ohio River Basin (February–April, 1915)		
Licking	2.60	31
Kentucky	3.47	81
Illinois River Basin (February–April, 1922)		
Kankakee	9.13	132
Fox	33.10	211
Vermillion	10.45	409
Mackinaw	2.28	243
Spoon	10.72	220
Macoupin Creek	5.76	585
Mississippi River Basin (February–April, 1927)		
Mississippi	3.95	7
Minnesota	4.49	9
St. Croix	2.54	0.4
Cannon	14.60	1
Zumbro	12.55	1

there should be an increase in quantity units with increasing populations. The data fail to show any such relation.

In the case of sewered population, the possibility of a definite relation between population and coliform organisms seems reasonable but the data also fail to show any correlation.

In order to determine whether under winter conditions, there might be some correlation, the data given in table 2 were studied. Again no correlation is indicated.

An inspection of the tabulated data does indicate, in general, the

larger the watershed, the smaller quantity of coliform bacteria per square mile at the river's mouth. This relation is shown by the data given in table 3. The probable reason for this correlation is the greater opportunity for natural purification in the larger streams.

The failure to show a correlation between populations and coliform bacteria may be influenced in part by the size of drainage area, although the data, as arranged in table 4, show that this explanation is true only when there is wide variation in areas.

TABLE 3

Drainage Areas and Coliform bacteria on Watersheds with Sewered Populations less than 5 per Square Mile

STREAM	DRAINAGE AREA SQ. MI.	SEWERED POPULATION PER SQ. MI.	COSECS PER SQ. MI.
Ohio River Basin, (August–October, 1914)			
Licking	3,651	2.60	94
Kentucky	7,059	3.47	84
Cumberland	17,936	4.86	5
Tennessee	40,608	4.25	2
Illinois River Basin, (August–October, 1921)			
Mackinaw	1,174	2.28	129
Crooked Creek	1,349	3.21	230
Mississippi River Basin, (August–October, 1926)			
Mississippi above Minneapolis	19,440	3.95	2
Minnesota	16,750	4.49	2
St. Croix	7,610	2.54	35
Chippewa	9,600	4.49	34

It is obvious that this attempt at correlation is essentially the determination of the number of coliform organisms per capita which reach and survive in streams draining populated watersheds. If it be assumed that the majority of these bacteria are derived from the sewered population, the per capita contributions of surviving organisms may be computed as in table 5. It will be seen from the table that there is a wide variation in per capita contribution of coliform bacteria.

Further evidence along this line is given in Bulletin No. 203 of

TABLE 4

Sewered Populations and Coliform bacteria for Watersheds with Drainage Areas less than 5000 Square Miles

STREAM	DRAINAGE AREA SQ. MI.	SEWERED POPULATION PER SQ. MI.	COSECS PER SQ. MI.
Ohio River Basin, (August–October, 1914)			
Licking	3,651	2.60	94
Illinois River Basin, (August–October, 1921)			
Fox	2,580	33.10	11
Vermillion	1,261	10.45	22
Mackinaw	1,174	2.28	129
Spoon	1,812	10.72	47
Crooked Creek	1,349	3.21	230
Macoupin Creek	944	5.76	44
Mississippi River Basin, (August–October, 1926)			
Cannon	1,520	14.60	3
Zumbro	1,420	12.55	20

TABLE 5

Coliform bacteria per Capita. Sewered Population—Summer Conditions

STREAM	COSECS PER CAPITA SEWERED	COLIFORM BACTERIA MILLIONS PER CAPITA PER DAY
Licking	36.0	88.2
Kentucky	24.2	59.3
Cumberland	10.3	25.2
Tennessee	0.5	1.2
Kankakee	0.5	1.2
Fox	0.3	0.7
Vermillion	2.1	5.2
Mackinaw	56.5	136.0
Spoon	4.4	10.8
Sangamon	1.9	4.6
Crooked Creek	71.6	175.0
Macoupin Creek	7.6	18.6
Mississippi	0.5	1.2
Minnesota	0.4	1.0
St. Croix	13.8	33.8
Cannon	0.2	0.5
Chippewa	7.5	18.3
Zumbro	1.6	3.9

the Public Health Service, from page 98 of which the data given in table 6 have been obtained.

In view of the fact that the large watersheds show smaller contributions of surviving coliform bacteria per capita, due evidently to the opportunities for self purification in an extensive river system, an attempt has been made to determine whether or not there may be a relation between sewered population within 150 miles of the sampling point and the quantities of coliform bacteria. A study of this question is summarized in table 7.

Again there appears to be no correlation between sewered population and the density of coliform bacteria.

TABLE 6

Coliform Organisms Added to Streams by Sewered Populations. Summer Conditions

	BILLIONS PER CAPITA PER DAY	
Chicago	433	
Peoria	231	
Cincinnati	583	
Louisville	291	
Minneapolis—St. Paul		
1926	43	
1927	28	
Pittsburgh	4	Affected by acid-iron wastes
Wheeling	24	

One other brief study has been made comparing this density in two streams upon the drainage areas of which there is no sewered population with the density in two other streams upon which the sewerage populations are moderately large. This comparison is shown in table 8.

In this case discharge data are not available, hence the results are expressed in numbers of coliform bacteria per cubic centimeter rather than in units of quantity. Such results are comparable with populations per square mile provided the runoffs per square mile are exactly equal. Although such was probably not the case, it is quite likely that the discharges per square mile were about the same.

From this table, it would appear that the drainage area with the lowest density of both total and sewered population gave the highest concentration of coliform bacteria. Of course, there may be reasons connected with the location of the sampling stations which

TABLE 7

Comparison of Coliform bacteria with Sewered Population in 150-mile Zone from Mouth—Summer Conditions

RIVER	DRAINAGE AREA SQ. MI.	SEWERED POPULATION 150-MI. ZONE OF MOUTH	(3) ÷ (2)	COSECS PER SQ. MI.
(1)	(2)	(3)	(4)	
Licking	3651	9500	2.6	94
Kentucky	7059	24000	3.4	84
Cumberland	17936	6400	0.4	5
Tennessee	40608	1400	0.03	2
Kankakee	5297	48331	9.1	5
Fox	2580	74788	29.0	11
Vermillion	1261	13178	10.5	22
Mackinaw	1174	2682	2.3	129
Spoon	1812	19452	10.7	47
Sangamon	5332	114754	21.5	40
Crooked Creek	1349	4336	3.2	230
Macoupin Creek	944	5428	5.7	44
Mississippi	19440	45070	2.3	2
Minnesota	16750	25680	1.5	2
St. Croix	7610	16240	2.1	35
Cannon	1520	22150	14.5	3
Chippewa	9600	38910	4.1	34
Zumbro	1420	7300	5.1	20

TABLE 8

Comparison of Coliform bacteria Content of Streams According to Density of Sewered Populations on Drainage Areas

	LITTLE KANAWHA	GUYANDOTTE	LITTLE MIAMI	HOCKING
Drainage Area	2,281	1,659	1,762	1,227
Total Population per Sq.Mi.	40	43	63	97
Sewered Population per Sq.Mi.	0	0	3.5	14.7
Coliform bacteria per c.c.				
1914—July	55	10	27	1
—August	550	32	127*	3
—September	262	206	181	6
—Oct. 1-15	100	10	54	1
Weighted Average**	262	63	103	3

* Abnormal result for single sample on Aug. 28 excluded from average for month.

** Counting October as one-half month.

Note: Samples every other day from Little Miami and once a week from other rivers.

would explain the paradox. In so far as the published record is concerned, there is no apparent reason.

In view of the preceding data, there seems to be no close and certain correlation between populations upon the drainage areas studied and the density of coliform bacteria in the streams to which such drainage areas are tributary. This conclusion raises several questions and points to need for further investigation. Is the coliform organism content of an unpurified surface water a reliable quantitative index of the sanitary hazards connected with its use or is the density of population, sewered or unsewered, upon a drainage area more reliable? Can the establishment of bacterial standards for purified and unpurified water be based upon sound principles of fact? With these two questions, unanswered, the facts as they appear to be are presented for consideration.

Discussion by SAMUEL A. GREELEY:* Mr. Chase arranges the bacteriological data collected by the United States Public Health Service (Bulletins Nos. 143, 171 and 203) with regard to the total and sewered populations upon the drainage areas and then indicates the conclusion that "There seems to be no close and certain correlation between population upon the drainage areas studied and the density of coliform bacteria in the streams. . . ."

When the results of such bacteriological investigations of pollution are expressed in general and average terms, the foregoing tentative conclusion must be apparent. Local conditions differ so much from one drainage area to another and at different points on the same stream, that trends and averages are of little use. Some of the variables and their effect are noted on pages 98 and 99 of Bulletin 203 as follows:

"Variations in the calculated per capita contribution of bacteria from a sewered population are influenced to a considerable extent by the amount and character of the industrial wastes reaching the sewers or water course; those having a high bacterial content tending to increase the number, while wastes germicidal in character cause a decrease in numbers. Variations also result from the nature and amount of surface run-off reaching the stream, either directly or through the sewers; the period of detention within the sewer system, minor tributaries or the main stream; the physical and biological condition of the receiving stream; and the relation of the various sampling points to the location of the sewer outlets. Accurate

* Greeley and Hansen, Chicago, Illinois.

measurements of the bacterial content of the river are only possible when the sewage is discharged into a comparatively narrow zone and when sampling stations are so spaced along the stream to give the actual maximum bacteria at all the stations."

"Estimates of the average daily per capita contribution of bacteria within the Twin City metropolitan area are influenced by the pool at Minneapolis, which increased times of flow and permitted sedimentation of sewage sludge which caused septic conditions in the pool during summer; by the discharge of sewage from a large number of outlets throughout the entire metropolitan area; by the inflow of the Minnesota River and by variations in times of flow from the sewer outlets to the sampling stations below the district. These factors combine to give an indicated lower per capita bacterial contribution on the upper Mississippi River than the contributions indicated from some of the other metropolitan areas, but are not entirely outside the range of previous observation and emphasize the fact that different local conditions may greatly affect the results."

The author concludes by posing two questions, as follows:—"Is the coliform organism content of an unpurified surface water a reliable quantitative index of the sanitary hazards connected with its use or is the density of population, sewered or unsewered, upon a drainage area more reliable? Can the establishment of bacterial standards for purified and unpurified water be based upon sound principles of fact?"

The coliform organism density, by itself, is not a completely reliable quantitative index of the sanitary hazards of an unpurified surface water; but progress is being made toward the use of such a figure as a guide, yardstick or standard of river and lake cleanliness.

The important thing is the relation between the quality of the water and the effect of its use upon people and industry as judged by experience. There is much evidence to show this relationship when an unpurified surface water is used for drinking. There is still a dearth of evidence when such waters are used for bathing or for oyster growing and taking. It appears, however, that the coliform organism content is an index which is more useful in correlating sickness and death statistics to the degree of pollution, than is the density of population.

The Conference of State Sanitary Engineers, in commenting on the use of water for outdoor bathing recommend in their 1932 joint Committee report: "... that public health workers must devote

increasing attention to the sanitation of bathing places along small streams, rivers, lakes and tidal waters. Not only do many bathing places in this category constitute a distinct health menace but the public is demanding more specific information. In passing on bathing water of this type, three aids are available: (1) the results of chemical analyses of the water; (2) the results of bacteriological analyses of the water; and (3) information obtained by a sanitary survey of sources of pollution, flow current, etc. Chemical analyses may in some cases be of value but are not ordinarily delicate enough."

The so-called sanitary survey is a necessary and important step in the application of a bacterial index to a particular pollution problem and cannot be discarded.

I do not understand the meaning of the second question posed by the author. A single bacterial standard can hardly be expected (and probably not a dual standard). But certainly, bacterial yardsticks related to experience can be based upon "sound principles of fact." The facts, however, must be fully developed and comprehended, and then applied with intelligence by experienced persons with due regard to the hazards involved in each particular case.

Discussion by J. K. HOSKINS:* Mr. Chase presents an interesting observation on the lack of uniformity of relationship between the sewered populations on several watersheds and the coliform group content of the receiving streams at their mouths. It could hardly be expected, however, that such a relationship would be found exact, irrespective of the length of time of flow from the sources of major contributions of pollution to the mouth of the stream where the samples were taken. In fact, if the relationship had been found exact, much of our knowledge of natural purification would have been contradicted and in reality no such self-purification would have been indicated. The extent of recovery from bacterial loads is dependent upon many factors, chief among which is time of flow. Obviously, therefore, without more definite knowledge of the origins of bacterial contributions in point of flow time above the source of the sample, employment of the data in the manner suggested by Mr. Chase, is not practicable. By this procedure we should be able to assume, for example, that the bacterial content of a stream in passing by a large city is increased in direct proportion to the increase in population on the watershed above and below the city. This,

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of course, is not the case for most of the bacteria contributed by scattered upstream sewered places have disappeared, particularly in warm weather low stream flow months, before the city in question is reached.

There is, however, a quite definite relation between sewered population and bacteria in the receiving stream observed at the point of maximum bacterial density below the point of sewage contribution and hence before material purification processes have become operative. This relationship was shown in a paper presented before the American Society of Civil Engineers (Trans. Am. Soc. C.E. 89:1365-77 (1926)), wherein the per capita contributions of bacteria from four cities as measured in the stream were computed. While the variations were considerable, they were generally of the same order of magnitude and afforded a means of estimating roughly, maximum bacterial pollution to be expected from known sewered population groups.

Author's Closure: The comments of Messrs. Greeley and Hoskins are along the lines which the author hoped his paper would bring out. The conditions involved in the bacterial pollution and self purification of rivers are so complex and variable that it is impossible to establish any simple bacteriological standard upon which to base an appraisal of the sanitary hazards to water supplies derived from polluted streams. Neither is it possible to base such an appraisal upon the populations discharging sewage directly or indirectly. Bacterial results are affected by a multitude of factors and many coliform bacteria in rivers are due to normal surface wash or "natural pollution."

There has been a tendency ever since the promulgation of the Treasury Department standard for drinking water used an interstate commerce to base opinions as to the safety of public water supplies upon this standard and more particularly that part of the standard relating to bacterial content. Furthermore, the setting of limits for bacterial loading upon water purification plants is also predicated upon the final effluent delivered complying with the standard. Such reliance upon a single simple standard, while convenient, cannot take the place of judgment based upon knowledge of all the available facts. Furthermore, in view of various sources of coliform bacteria, there can be no even approximate correlation between bacterial counts and hazards to health.

Mr. Hoskins calls attention to the figures for per capita contributions for coliform bacteria published in the Transactions of the American Society of Civil Engineers. The author's paper presented summer figures for Chicago, Peoria, Cincinnati and Louisville together with figures for Minneapolis-St. Paul, Pittsburgh and Wheeling. The question arises when these figures are examined as to whether the per capita contributions of sewage from the people of Minneapolis-St. Paul District are one-tenth as dangerous as those from Chicago, for example. Furthermore, on the basis of the relative contributions in the summer and winter, summer sewage should be considerably more dangerous than winter sewage. Whereas it is reasonably well established that typhoid outbreaks due to untreated water supplies are relatively more frequent in winter than in summer due partly to the shorter time between sewer outlets and waterworks intakes and partly to the greater longevity of the typhoid bacillus in cold water.

What the author was attempting to do in his paper was to point out the difficulties inherent in correlating limited bacterial data with the probable health hazards involved in using polluted waters with or without purification. The engineer who is called upon to decide between different sources of supply or to determine the degree of sewage treatment required to safeguard the raw water supply of a lower municipality cannot base his opinions upon bacterial standards alone. In the first place bacterial data, even in such unusually extensive investigations as those by the United States Public Health Service, are too limited, and, in the second instance the correlation between bacterial results, actual pollution and health hazards are far too uncertain. The engineer must make his decision upon all the available facts, physical, chemical and bacterial, relating to the source of supply. This is an old story but one which needs constant repetition and emphasis.

DROUGHT CONDITIONS IN ONTARIO*

By A. E. Berry

(Ontario Department of Health, Toronto, Ont.)

Extremes in weather conditions are encountered throughout the world, and at intervals which challenge prediction. Meteorological abnormalities are more frequent in some countries or parts of a country than in others. While droughts of somewhat serious intensity have been experienced in a number of places in recent years, the Province of Ontario has been relatively free from this condition. However, in the summer of 1936 a severe drought visited parts of the province, and created a situation which makes a parallel case somewhat difficult to recall. The temperatures were high for a very prolonged period, and the rainfall was abnormally low.

The effect of this drought was felt in the public and private water supplies, where consumption was exceedingly high and the available quantities were not always adequate. Similarly difficulties were encountered in the disposal of sewage, brought about by the reduced flows in streams, and the accompanying putrefaction of organic matter hastened by the high temperatures. These conditions were met for much longer periods than memory recalls for similar occasions.

WHAT IS EXPECTED IN A DROUGHT?

Experience has not been lacking in the effects which droughts bring. Dry weather for certain periods is common in most every country, but it is only when this period is pronounced and is accompanied by hot weather that the full effects are felt on water supplies and similar activities. Consequently, in a sustained drought we must look for a material reduction in rainfall, an increase in temperature, together with a prolonged period of this. An examination of the records for the province of Ontario in the summer months of last year show all these factors to be present. There was in general a marked reduction in precipitation, accompanied by pro-

* Presented before the Canadian Section, 1937.

longed hot weather. This brought in its train serious difficulties in waste disposal in small streams. Apart from waterworks and sewerage this condition also had a decided effect on crops. Fatalities due to heat were marked, and normal activities in business could be carried on only under difficulties.

PRECIPITATION DATA

An examination of the rainfall statistics for the past summer brings to light some interesting observations. For purposes of comparison over the entire province 30 meteorological stations have been selected, and the monthly rainfall records at these are tabulated in table 1 for the months of May, June, July, August and September. These rates are compared with the normal rates for these stations as published in the meteorological records for the Dominion. This tabulation shows that the averages of the normals of these stations give rates of 2.6, 2.9, 3.0, 2.8 and 3.0 inches respectively for each of these five months. The 1936 averages for these months show the following: 1.7, 2.5, 1.4, 2.3 and 3.7. The rainfall was below normal for all these months except September, and in this it was 0.7 inches above normal. The greatest deficiency occurred in July where the rate was less than 50 per cent of normal. The month of May was next, but this deficiency was somewhat offset by the month of June. In August there was an approach to normal, but still some deficiency, and in September the rate was in excess of the normal. The total rainfall for the five months was 2.7 inches short of normal, or 81 per cent of normal. The Toronto station shows rainfall for the year as 84 per cent of the normal.

The total figures or averages do not altogether represent the extreme conditions met in some localities. The drought was not uniform over the entire province, nor was the duration of this at all even. The northwestern part of the province experienced a shortage of rain, but it was much less intense than in some other centres. It was only in the month of July that the rainfall there was much below normal. In Northern Ontario at North Bay, Haileybury, Cochrane and Kapuskasing, there was scarcely any deficiency in rainfall. In the Windsor district the only month of marked deficiency was July. In the London area the low rainfall occurred in July and August with June being above normal. At Toronto the only month to reach normal was June. At Belleville and Peterborough both May and July were low, but August and Septemer made up for the

low fall. At Kingston and Brockville the rainfall was spread well over the five months with above normal rates in some months.

TABLE 1

Precipitation data—Ontario. Normal and 1936 rates for 30 Ontario stations

METEOROLOGICAL STATION	MAY		JUNE		JULY		AUGUST		SEPTEMBER	
	Normal	1936	Normal	1936	Normal	1936	Normal	1936	Normal	1936
Atikokan	1.56	2.4	3.27	1.3	3.48	1.9	2.54	2.2	2.94	3.5
Sioux Lookout	2.00	1.1	3.28	2.1	3.84	1.6	2.71	2.3	3.80	3.1
Kenora	2.68	0.6	3.23	2.1	4.86	3.0	3.50	1.9	3.14	2.4
Port Arthur	2.03	2.5	2.75	1.8	3.62	1.7	2.86	4.4	3.14	2.1
Schreiber	1.87	1.8	2.69	2.0	2.81	0.6	3.03	2.3	3.28	3.7
Gore Bay	1.84	3.4	2.0	1.5	2.09	0.6	2.37	4.5	2.52	3.1
North Bay	2.72	2.4	2.79	2.8	2.93	4.2	2.52	4.3	3.57	3.8
Haileybury	2.91	4.4	2.9	1.5	3.85	3.2	2.94	1.2	3.37	3.0
Cochrane	2.33	3.5	2.33	2.7	3.73	1.6	3.52	1.4	3.31	2.9
Kapuskasing	1.98	2.8	2.30	2.8	3.26	1.4	2.62	1.7	3.55	2.3
Huntsville	3.12	2.1	3.58	5.4	2.94	2.2	2.98	4.6	3.97	2.9
Orillia	2.63	1.8	2.80	3.8	2.80	0.4	2.60	2.0	2.86	4.7
Owen Sound	2.6	1.4	2.56	2.6	3.04	0.3	2.81	4.8	2.92	2.3
Goderich	2.78	1.5	3.02	0.7	2.95	1.2	2.48	2.5	2.81	6.0
Chatham	3.08	0.6	2.69	3.6	2.73	0.9	2.57	1.0	2.64	3.9
Harrow	2.2	1.2	3.15	3.2	1.97	1.0	2.49	2.0	2.82	4.6
Leamington	2.57	1.2	3.42	3.3	1.95	0.7	1.94	2.2	2.75	3.0
Simcoe	2.9	0.7	2.92	1.5	3.13	0.9	3.33	0.9	3.07	4.1
London	3.26	1.1	3.05	3.1	3.06	0.5	2.84	1.7	2.88	5.4
Stratford	3.34	1.2	3.25	3.9	3.31	0.9	3.07	1.0	3.38	4.5
Brantford	3.1	0.9	2.74	1.9	3.18	0.6	3.08	1.1	2.43	3.5
St. Catharines	2.26	1.6	2.29	1.1	2.42	1.8	2.86	1.0	2.39	3.3
Grimsby	3.14	0.6	3.05	2.1	2.46	0.6	3.26	1.0	2.62	3.8
Guelph	2.78	2.0	2.8	3.7	2.97	1.1	2.83	1.6	2.33	5.1
Toronto	2.98	0.7	2.76	2.9	3.04	0.8	2.77	1.8	3.18	2.9
Belleville	2.4	0.7	2.55	1.1	2.2	0.8	2.26	2.8	3.46	3.4
Peterborough	2.57	1.1	2.62	3.3	2.91	0.4	2.52	2.6	2.84	4.3
Brockville	2.54	1.0	2.99	2.4	2.75	1.7	2.68	3.4	2.73	4.3
Kingston	2.92	2.0	2.87	2.1	2.81	2.1	2.71	2.2	2.76	4.5
Ottawa	2.58	2.4	3.38	2.0	3.34	4.3	2.91	3.0	2.79	4.2
Total	77.67	50.7	86.03	74.3	90.43	43.0	83.6	69.4	90.25	110.6
Average	2.59	1.7	2.87	2.5	3.01	1.4	2.79	2.3	3.01	3.7

For the month of July the rainfall for these 30 stations shows that 14 had less than 1 inch of rain as against a normal of 3 inches, while

only 5 stations had more than 2 inches. The lowest fall for this month was at Owen Sound with 0.3 inches. For this month marked deficiencies were noted in Manitoulin, and all Southern Ontario except the St. Catherines area and the most Eastern part of the province.

For these areas the recorded rainfall averaged 0.7 inches or 27 per cent of the normal for these stations.

TEMPERATURES

Rainfall deficiencies and high temperatures combine to intensify drought conditions. A tabulation of the mean monthly temperatures for the summer of 1936 at these 30 stations (table 2) over the province shows the highest average temparature in July; although the months of May and September gave higher percentage increases over their normals. The month of June showed for the province a temperature slightly below normal. The highest mean for July, 75, was recorded at Kenora, and this was 11 degrees above normal. At Toronto the monthly mean was 73, or 5 above normal. While this figure was exceeded in the Chatham-Windsor area the mean for this is higher than Toronto. The Ottawa area in no month of the five had a higher temperature than normal.

The effects of the drought is not shown so clearly by the temparatures as by the rainfall. This is probably due to the fact that most damage was occasioned by periods of intense heat which were interspersed with cool periods.

STREAM FLOWS

The low rainfall, combined with greater evaporation from the high temperatures, had a marked effect on stream flow. Many stream beds which normally would contain water all summer were completely dry in 1936, and others had very reduced flows. The larger streams were not altered to the point where noticeably abnormal conditions occurred. In the Province of Ontario there are a number of streams of medium size which are used either for water supplies or the disposal of sewage. It was these which were affected to the greatest degree. The Grand River rising above Fergus is one of this kind. It carries off the sewage of Fergus, Waterloo, Kitchener, Hespeler, Galt, Brantford and Dunnville. The Thames River is used both for domestic water supplies and sewage disposal.

TABLE 2

Temperature data—Ontario. Normal and mean monthly temperatures for 30 Ontario stations

STATION	MAY		JUNE		JULY		AUGUST		SEPTEMBER	
	Normal	1936	Normal	1936	Normal	1936	Normal	1936	Normal	1936
Atikokan	50	55	62	59	66	70	62	63	54	56
Sioux Lookout	48	50	60	58	65	72	61	63	54	54
Kenora	48	56	61	61	64	75	61	66	52	56
Port Arthur	47	47	57	55	63	64	59	60	53	53
Schreiber	46	44	56	53	59	64	58	58	50	51
Gore Bay	50	51	59	57	64	69	64	64	57	57
North Bay	52	52	62	59	66	67	64	61	56	56
Haileybury	51	48	61	59	67	67	63	62	55	56
Cochrane	47	42	58	55	63	64	59	60	51	52
Kapuskasing	48	43	58	55	61	64	58	60	50	52
Huntsville	52	55	61	61	65	67	63	63	56	58
Orillia	54	54	63	61	68	69	63	65	59	59
Owen Sound	52	54	62	60	67	67	64	65	59	59
Goderich	53	57	62	61	66	69	65	68	60	63
Chatham	56	61	66	65	70	73	68	72	62	65
Harrow	58	62	67	66	72	74	70	74	64	66
Leamington	58	61	66	66	71	74	70	73	63	67
Simcoe	56	59	64	66	70	72	68	70	60	63
London	56	58	65	62	69	70	66	69	60	62
Stratford	54	60	64	64	68	71	64	69	59	62
Brantford	55	60	65	66	70	72	67	69	60	62
St. Catharines	55	59	66	65	70	72	68	70	62	64
Grimsby	55	58	66	65	70	73	68	69	62	63
Guelph	53	58	64	63	68	67	66	68	58	61
Toronto	53	59	63	65	68	73	67	69	59	63
Belleville	55	58	64	65	69	71	66	68	59	61
Peterborough	54	59	64	65	69	72	66	68	59	61
Brockville	54	58	65	64	70	68	67	66	60	60
Kingston	53	54	63	63	68	69	67	67	60	61
Ottawa	56	56	64	63	69	67	66	64	58	58
Average	52.6	54.9	62.6	61.6	67.2	69.5	64.6	66.1	53.7	59.4
Percent greater or less than normal	+4		−2		+3		+2		+11	

These two are probably the most prominent for sanitary purposes in the province.

An examination of the stream flows in these two typical rivers

(tables 3 and 4) covering a number of years indicates the very low flows for 1936 during July and August. The Grand River was particularly impressive in that new all time minimum records were established both for single day flows and monthly flows. The month of August had a flow of only 47 c.f.s. which also included the sewage from the municipalities of Waterloo, Kitchener and Preston.

TABLE 3

Grand River at Galt

Flow in c.f.s.

YEAR	MAY	JUNE	JULY	AUGUST	SEPTEMBER
Mean, 1913–21	1,000	630	570	314	377
1926	1,280	535	132	815	750
Mean, 1913–27	1,220	590	470	309	346
1929	1,840	383	319	142	95
1931	1,260	298	178	93	104
1935	630	1,400	350	86	68
Mean, 1913–25	1,090	535	387	267	
1936	650	415	*55*	*47*	91

The minimum daily flow, prior to 1936, was 29 c.f.s. on Sept. 3, 1934. In 1936 this was lowered to 26 c.f.s. on Aug. 9th. New minimum monthly flows were established in both July and Aug. of 1936.

TABLE 4

Thames River (north and south branches—total)

Flow in c.f.s.

YEAR	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER
1926	521	251	88	547	1,011	
1928	385	858	429	370	151	
1930	495	374	136	82	108	
1931	542	185	470	305	172	
1936	632	295	*58*	*36*	*53*	*90*

EFFECTS ON WATER SUPPLIES

The drought of 1936 was a testing time for many waterworks systems. In a number of systems new peaks for consumption were created, while in others drastic measures had to be taken to cope with the situation. Some supplies either failed or came very close to this point. In this latter group the town of Dundas was con-

spicuous. Here the supply, obtained from a reservoir on a small stream, failed completely, and drinking water was brought in by tanks. Heavily chlorinated water from an emergency source was pumped into the mains, and used for sanitary purposes. The possibility of this occurring in the future has been obviated by the construction of a new line to connect with the City of Hamilton. Other municipalities depending on similar sources of supply were also in difficulty, but by curtailing the use of water were able to come through this period without serious difficulties. Well water supplies were given a severe testing in a number of places, but these in most cases did not fail through any deficiency in the underground supply, but rather due to the fact that the supplies had not been developed to take care of such high demands. Either additional wells or greater pumping capacities were required.

The drought was not responsible for any disease outbreaks associated with public water supplies. Complaints as to taste were likewise not a serious matter in this time.

The effects of the drought on the waterworks systems of the province have been an increased interest in providing for prolonged periods of high consumption. A number of municipalities had hesitated about installing new supply works or providing pumping equipment and feeder mains of greater capacity. This drought has been an object lesson in the need for preparation against such emergencies. In this respect it has been valuable, and has created a better interest by the public in waterworks systems.

EFFECT ON SEWAGE DISPOSAL

In the disposal of sewage and other wastes the drought created difficult problems. The reduction in stream flow, coupled with the high temperatures, tend to decomposition and offensive odors. Such rivers as the Grand and Thames, with their heavy load of sewage, were the cause of many complaints. The abnormally low flows make such a condition obvious. In other places the effluents of disposal plants were discharged into dry stream beds, and in spite of the good quality of these effluents complaints could not well be avoided. In one instance the effluent of nearly one-half million gallons daily was discharged into a dry creek, and this flow disappeared a short distance below the outfall.

The correction of stream pollution in a short period is seldom easy and in this respect complaints are not easy to overcome.

The drought has likewise been important in bringing before municipal officials a realization of the need for proper disposal of sewage. These matters require a good deal of planning in advance rather than when the difficulty is at hand. Conservation of stream flow may be utilized to correct such conditions as encountered last year. The removal of bush land and the utilization of swampy areas has resulted in rapid runoffs followed by periods of excessively low flows. The conservation scheme, now being considered for the Grand River is designed to overcome such conditions as were experienced last year.

DROUGHTS IN OTHER COUNTRIES

The drought of 1936 in certain parts of Ontario may be compared with interest with those which have visited other countries. Droughts have been prevalent in certain parts of Western Canada. The effects of these have been decidedly greater than that experienced in Ontario. This was due to the prolonged period, and to the fact that certain sections of the country might be termed dry belts in which rainfall deficiencies and droughts are so common as to create very difficult farming. Droughts in Western Canada have been much more pronounced than in Ontario.

In some parts of the United States serious difficulties have resulted from droughts. From December 1929 to 1931 a number of states including West Virginia, Pennsylvania, Missouri, Virginia, Ohio and Maryland experienced marked deficiencies in rainfall. In West Virginia the December 1929 precipitation was 74 per cent of the normal, and every month from this date to April 1931 was below normal. In 1930 the total rainfall was 59 per cent of the normal, and in January 1931 it was down to 35 per cent of the normal.

In Pennsylvania the 1930 precipitation was 68 per cent of the normal, with the effects most marked during the last 6 months of the year. During July, August, September and October, the deficiency was 8.3 inches, or 53 per cent of normal. A summary of 35 years shows the maximum drought duration as 7 months.

In Missouri the rainfall of 1930 was 79 per cent of normal. Water supplies were less seriously affected than some places due to the use of underground sources.

In Virginia the drought started in December 1929. The total rain for 1930 was 60 per cent of normal. For 15 months there was a subnormal rainfall. Of the 244 public water systems 36 had to resort to emergency measures.

In Maryland the precipitation for 1930 was 56 per cent of the normal.

The Susquehanna River gave an interesting occurrence in that the salt content rose from a normal of 7 to 8 parts per million to a maximum of 885 parts per million, a point which caused a salty taste.

Comparisons of the conditions found in these other places with Ontario brings to notice that while our drought was just as severe it did not last nearly so long.

THE QUEBEC STREAMS COMMISSION*

By J. E. Gill, C.E.

(Quebec Streams Commission, Quebec)

Statistics from the Department of the Interior of Canada show that there were in Canada in 1900, water power developments to the extent of 200,000 H.P.; in 1910, 900,000 H.P.; in 1920, 2,500,000 H.P.; and in 1936, 7,909,000 H.P.

The estimated capital invested in water power developments in 1936 was $1,890,000,000.00.

Further possible additional developments in Canada amount to 28,000,000 H.P.

Water power developments in the Province of Quebec have grown in about the same proportion as the whole of Canada and total today 3,853,000 H.P. which represent about 25 per cent of the water powers available for developments in the province.

The development of water powers in Canada was just beginning in 1900, the rapid strides in the following years have shown the legislators of the Province of Quebec the necessity of a thorough study of the resources under their jurisdiction. In 1910, a law was passed creating the Quebec Streams Commission, said Commission to be composed of three members and to be guided in its duties by the following articles:

1. "To devise just and practical rules respecting the flow, the drawing off, the disposal, the distribution, the storage, and generally respecting the preservation and management of running waters in the Province of Quebec.

2. "To determine whether the laws of the Province governing water-courses, as regards floating of timber, the flow, drawing off, disposal, distribution, and storage of water, ought to be amended.

3. "To make any suggestion tending to the adoption of practical rules adapted to protect the forests of this Province belonging to the Crown or to private persons, and to encour-

* Presented at the Canadian Section meeting, April, 1937.

age and facilitate the utilization of water powers, while reconciling the interests of agriculture, of industrial pursuits, and of the forests with respect for property rights.

4. "To consider whether it is expedient to have the rivers of the Province classified as navigable and floatable rivers, and rivers which are not navigable or floatable, by an administrative commission or otherwise, according to uniform rules, and to submit such rules, if it be advisable.

5. "To make any inspections and examinations of the lakes, rivers, ponds, creeks, and watercourses in this Province, which it may think necessary.

6. "The Commission shall proceed with all possible diligence to carry out the purposes for which it is constituted. In matters not provided for by this Act, it shall be guided by instructions from the Lieutenant-Governor in Council.

7. "The Commission shall report to the Lieutenant-Governor in Council as to its researches, as well as its recommendations and suggestions. This report shall be laid before the Legislature during the first ten days of the next session."

It is to be noted that up to 1910 practically no data were available on the water courses of the Province, except those taken by private companies on a very few streams.

Members of the new Commission were appointed in December 1911 with Honourable S.N. Parent as Chairman and Messrs W. I. Bishop and Ernest Bélanger, engineers, as commissioners. In 1921, after the death of Mr. Parent, Honourable J. A. Tessier was named Chairman, and later on was succeeded by Honourable Honoré Mercier. Messrs Bishop and Bélanger were replaced by Messrs Arthur Amos and Stewart Rutherford, both engineers.

In 1912, the Commission made numerous investigations on different rivers, mostly concerning floods and log driving difficulties. Storage possibility on the St. Maurice River was also looked into.

In 1913, the Commission became more important and an engineering staff was appointed with Mr. Olivier Lefebvre as Chief Engineer. Mr. Lefebvre is presently Acting Chairman of the Electric Commission of the Province of Quebec.

STREAM MEASUREMENTS

Measurement of the flow on the principal rivers was immediately organized. Metering sections were taken where convenient and

gauges to be read daily or oftener were established. Flows at those metering stations were measured and were related to the gauge readings.

The number of metering stations established and of streams investigated has grown every year so that presently data on flows and water power sites are available on most all of the important streams of the Province of Quebec.

Since 1922, the metering of the flows of rivers is done by the Dominion Water Power Branch of the Department of the Interior of Canada, under Mr. Léo G. Denis, District Engineer with headquarters in Montreal. This came to be through an agreement with the Commission whereby the two services co-operated to the best advantage of the province.

Data on gauge heights and flows can be obtained either from the Commission's or from the Dominion Water Power Branch's records.

The average yearly run-off from streams in the province, is about 1.6 second-feet per square mile of drainage area. The ordinary maximum run-off, occurring in the spring, varies from 6 to 10 second-feet on the larger rivers and from 20 to 25 second-feet on the smaller streams.

The minimum flow takes place in winter, usually in March, and is sometimes as low as 0.25 second-feet per square mile of drainage area.

Flood flow have attained occasionally larger maxima than the ones mentioned above. A flow of 64 second-feet per square mile of drainage area has been observed at St. Alban on Ste-Anne de la Pérade River in 1924; on Ste-Anne de Beaupré River a flow of 80 sec. ft. per square mile from a drainage area of 400 square miles was also observed. Lake Kenogami, in the Saguenay district, had a flood run-off of 20 second-feet per square mile from a drainage area of 1,400 square miles.

METEOROLOGICAL DATA

The work of collecting meteorological data has been initiated by the Dominion Meteorological Service of Canada (a branch of the Department of Marine and Fisheries at Ottawa) with headquarters at Toronto.

The Quebec Streams Commission took great interest in this work, and suggested a large number of new stations. It has offered its full co-operation to the federal service. There are now 121 stations throughout the province, where rainfall and temperature are recorded. The data are sent monthly to the Commission and trans-

mitted to the federal office. This information is tabulated and put in proper form for distribution to engineers. The Provincial Government, through the Commission, pays the observers, and many stations are in charge of power companies and manufacturing firms, the co-operation of which is greatly appreciated. The Streams Commission supervises the collection of this information and follows closely the work of the observers who are being impressed with its value and the importance of recording it properly.

It may be of interest to state that the average annual rainfall in the Province of Quebec is about 36 inches, including snow. The average snowfall is about 100 inches, which is considered to be equivalent to 10 inches of rainfall. The loss from evaporation and vegetation has been found to be from 9 to 12 inches yearly, dependant on the temperature of the section concerned and the rainfall.

RUN-OFF

Run-off varies considerably from year to year and there is also a great variation in the same months of different years. Some statistics from the Gatineau River storage and the Kenogami storage, given below, are certainly of interest.

The Gatineau River storage draws water from an area of 6,250 square miles or 4,000,000 acres. The statistics show that between 1926 and 1936, the yearly run-off has varied from 13.52 inches to 30.16 inches, and the mean for the ten years was 21.54 inches; that the lowest run-off per month in that period was .38 of an inch and the highest run-off per month was 8.71 inches in May 1928.

The Kenogami storage receives water from an area of 1,400 square miles or 895,000 acres. The yearly run-off to this storage varied for 1926 to 1936 from 19.76 inches to 36.32 inches; the run-off of the lowest month was 0.26 inch and of the highest month 11 inches. The yearly mean run-off in that period was 29.48 inches while the yearly mean precipitation was 39.66 inches, which means a loss through evaporation and absorption by vegetation of about 10.18 inches yearly.

POWER SITES

The Quebec Streams Commission has investigated a great number of water power sites in all districts of the Province.

Numerous surveys and plans have been made of the power sites of the principal streams and estimates of the available power and probable costs of the developments were prepared.

Such information was furnished to the Minister of Lands and Forests and negotiations for the concession of power sites are to be made through the Hydraulic Service of the Province of Quebec.

STORAGE RESERVOIRS

The principal work of the Commission, however, consists in the study of water storage possibilities for the regulation of the flow of rivers, the construction of the necessary dams for these storage-reservoirs and their operation after the construction.

From 1912 to 1925, storage-reservoirs were built or acquired and operated by the Commission, charges being made to benefiting companies covering interest and amortization on the capital invested as well as the cost of operation.

Since 1925, companies or persons availed themselves of the latitude given them by Section VI, Chapter 46 of the Revised Statutes of 1925, to build the necessary dams for impounding water in reservoirs, subject however to rules and conditions that may please the Lieutenant-Governor in Council. Such storages built since then have been transferred to and operated by the Commission; the cost of operation being charged annually to the interested companies or persons.

There are presently eighteen storage-reservoirs in the Province of Quebec. Statistics about some of them will be no doubt of interest; they are given below.

St. Maurice River. The St. Maurice River is about 350 miles long and drains an area of 17,000 square miles or 10,900,000 acres.

The present power developments on this river amounts to 680,000 H.P. and a further development of 350,000 H.P. is possible.

The regulation of the flow is made through a storage system including Gouin Reservoir, Manouane River Reservoirs and Mattawin Reservoir.

Gouin Reservoir controls a drainage area of 3,650 square miles or 2,340,000 acres; its storage capacity is estimated at 5,722 square-mile-feet or 3,670,000 acre-feet. Those last figures apparently are much too low and are to be revised when more accurate data are available. This reservoir has been operated since the beginning of 1918.

Manouane River system of three reservoirs controls a drainage area of 1,180 square miles or 757,000 acre-feet and has a storage capacity of 680 square-mile-feet or 435,000 acre-feet.

Mattawin Reservoir, on the Mattawin River which drains in the St. Maurice some 25 miles above Shawinigan, has a storage capacity

of 1,151 square-mile-feet or 736,000 acre-feet and controls a drainage area of 2,200 square miles or 1,408,000 acre-feet. This last reservoir is in operation since December 1930.

Those three storage reservoirs which control a drainage area of 7,030 square miles or 4,500,000 acre-feet, being 41 percent of the whole drainage area of the St. Maurice River, permit to regulate the flow at Grand'Mère and Shawinigan at 18,000 second-feet, while the average minimum flow on the St. Maurice at those stations was 5,000 second-feet before the regulation.

St. François River. The St. François River, on the south shore of the St. Lawrence and having its outlet in Lake St. Peter, drains an area of 3,930 square miles or 2,520,000 acres.

Two storage-reservoirs regulate its flow: one at Lake St. François and one at Lake Aylmer.

Lake St. François Reservoir controls a drainage area of 472 square miles or 302,000 acres and has a storage capacity of 438 square-mile-feet or 280,000 acre-feet.

Lake Aylmer Reservoir controls a drainage area of 158 square miles or 101,000 acres and has a storage capacity of 125 square-mile-feet or 80,000 acre-feet.

The area controlled by those two reservoirs equals a little over 16 percent of the whole drainage area of St. François river.

The Lake St. François reservoir has been in operation since 1918. The Lake Aylmer reservoir is controlled by a dam which has been in existence for many years and was acquired and rebuilt by the Commission some twenty years ago.

It is estimated that those two reservoirs raise the minimum flow in St. François River by at least 650 second-feet.

Water power developments on St. François River amount to 100,000 H.P. and further possible developments would be 50,000 H.P.

Kenogami Reservoir. The Kenogami Reservoir is in the Lake St. John District and drains into the Saguenay River through Au Sable and Chicoutimi Rivers; it controls a drainage area of 1,400 square miles or 895,000 acres and has a storage capacity of 486 square-mile-feet or 311,000 acre-feet.

This storage-reservoir permits the regulation of the flow in Chicoutimi River at 1,200 second-feet and in Au Sable River at 600 second-feet.

Water power developments on Chicoutimi River amount to 41,400 H.P. and further developments to the extent of 14,300 H.P. are possible.

On Au Sable River 33,200 H.P. are installed and a further development of 2,000 H.P. is possible.

The Kenogami storage is in operation since 1924.

Gatineau River. The Gatineau River has a drainage area of 9,600 square miles (6,200,000 acres); its minimum flow before the regulation was 3,000 second-feet. By the construction of the Baskatong and Cabonga storage reservoirs, a regulated flow of 10,000 second-feet is now possible. Those reservoirs were in operation in 1926 and 1929 respectively.

The total drainage area controlled by those reservoirs is 6,250 square miles (4,000,000 acres) which is 65 percent of the total drainage area of Gatineau River at Chelsea.

Baskatong Reservoir controls a drainage area of 5,200 square miles (3,325,000 acres) and has a capacity of 3,495 square-mile-feet (2,230,000 acre-feet).

Cabonga Reservoir controls a drainage area of 1,050 square miles (670,000 acres) and has a capacity of 1,674 square-mile-feet (1,070,000 acre-feet). This last reservoir is used to a certain extent as a stand-by for lean years.

Storage on the Gatineau equals 8 inches at the Baskatong Reservoir and 19½ inches at the Cabonga Reservoir, on the respective drainage areas.

Installed water powers on the Gatineau amount to 470,000 H.P. and further developments of about 160,000 H.P. are possible.

Lievre River. The Lievre River has a total drainage area of 3,700 square miles (2,370,000 acres). Its minimum flow was 1,200 second-feet before the regulation by the Cedar Rapids storage-reservoir. Except in lean years it is presently possible to regulate the flow at 3,400 feet per second.

The James MacLaren Company, who owns the power developments benefiting from the regulation, contemplates the construction of new storage-reservoirs which would improve the situation.

Cedar Rapids storage-reservoir controls a drainage area of 3,000 square miles (1,920,000 acres); it has a normal capacity of 661 square-mile-feet (424,000 acre-feet) and an ultimate capacity of 781 square-mile-feet (495,000 acre-feet). This capacity is equal to about three inches on the drainage area.

The Cedar Rapids storage-reservoir has been in operation since 1930.

Installed water power developments on the Lievre River amount presently to 274,000 H.P. New storage-reservoirs will permit a higher

regulation and consequently the addition of new power units at the benefiting plants.

Other storage-reservoirs operated by the Commission are: the Lake Mitis Reservoir which controls 143 square miles (91,000 acres), the Savane River Reservoir controlling 18 square miles (11,500 acres), and three small reservoirs on North River.

Among storage-reservoirs not controlled by the Commission are: the Lake St. John Reservoir with a drainage area of 30,000 square miles (19,200,000 acres) with a storage capacity of 8,020 square-mile-feet (5,140,000 acre-feet) and the Onatchiway Reservoir on the Shipshaw River, which controls a drainage area of 795 square miles (510,000 acres) and has a storage capacity of about 280 square-mile-feet (179,000 acre-feet).

Power developments on the Saguenay River, which benefit from the Lake St. John storage, amount presently to 710,000 H.P. and it is further possible to increase the development at Chute-à-Caron by 540,000 H.P.

Further studies of the water power resources of the Province of Quebec will add to the present available data and help in the design of new power developments in a practical and economical way.

All data that the Commission possesses on power sites, stream flow and meteorology, are available to interested inquirers.

STATE HEALTH DEPARTMENT SUPERVISION OF WATERSHEDS OF STREAMS*

By H. P. Croft[1] and D. M. Ditmars[2]

This paper is presented in order to acquaint the operators, engineers and others actively engaged in the distribution of public potable water in New Jersey with the authority of the State Department of Health in the protection of streams which are used for potable purposes. The premise upon which effective supervision of sanitary conditions depends, in the writers' opinion, is that there must be powers established by law (distinguishing here, between specific legal powers and those which are believed inherent in any governmental agency of good repute) and that there must be legal justification for the duties established or performed. With this in the background, the following references to certain laws, to the creation and abolition of certain state agencies, and to court decisions, are made to outline the present legal authority for the activities of the Department of Health of the State of New Jersey in the abatement and prevention of pollution of streams which are or may be sources of potable water.

In the pamphlet containing the public health laws of the State of New Jersey, especially those laws relating to stream pollution, water supplies and sewerage systems, references are made, some time in the same law, to "the State Board of Health," "the State sewerage commission" and "the Department of Health of the State of New Jersey."

The State Sewerage Commission was created by the approval, in March 24, 1899, of "An Act to prevent the pollution of the waters of this state by the establishment of a state sewerage commission . . ." (Chapter 210, P. L. 1899). And at the same session of that legislature, there was approved March 17, 1899, "An Act to secure the purity of the public supplies of potable waters in this State" (Chapter

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41, P. L. 1899). This lodged the enforcement of this law—in so far as a state agency is concerned—in the existing State Board of Health (established in 1877). Therefore, in 1899, there existed, by legislative dictum, two classes of state waters—(a) all waters, and, (b) waters used for public potable and domestic purposes—and two state agencies which functioned in the supervision of stream pollution. The legislature of 1900 amended the act of the previous year creating the State Sewerage Commission so as to enlarge or increase the powers of that body. (Chapter 72, P. L. of 1900.)

From available data it is concluded that the aforementioned state agencies were not performing their duties in a cooperative manner. It is also concluded that the classification of the waters of the State and the establishment of a split authority produced a chaotic condition in state sanitation. To support these conclusions, reference is made to the decision of the Court of Errors and Appeals, on November 13, 1906, in the State, ex rel: The Board of Health of the State of New Jersey v. Borough of Vineland. The bill in this cause was filed by the Attorney General at the relation of the State Board of Health, "under the provisions of An Act to secure the purity of the public supplies of potable waters in this State", to restrain the Borough of Vineland from discharging the effluent from its municipal sewer system into waters, later used as a source of public water supply for the municipality of Millville. The opinion of the Court of Errors and Appeals is, in part, as follows:

> "This difference in the two acts"—the Potable Water Act (Chapter 41, P. L. 1899) and the State Sewerage Act (Chapter 210, P. L. 1899)—"would seem to be the basis of the present litigation, for by the proofs it appears that the works of defendant municipality were constructed and are being operated pursuant to the consent and approval of the state sewerage commission, and complainant's contention is that notwithstanding that fact potable waters are being polluted through the operation of those works. It appears manifest, however, that in the enactment of the amended sewerage act now under consideration (each section of Chapter 210, P. L. 1899 was amended by Chapter 72, P. L. 1900) the legislature intended to bestow upon the state sewerage commission the power and duty to fully supervise and control the entire subject of pollution of public waters occasioned by the discharge of sewage, drainage or other

polluting matter into such waters and the power and duty to prevent such pollution, and this manifest legislative purpose clearly negatives any possible legislative intent to preserve to the state board of health the right to enjoin the operation of works which have been constructed and are being operated pursuant to the consent and directions of the state sewerage commission. Any conception that the legislature intended to preserve to the state board of health the powers contended for includes the assumption that the state sewerage commission would fail in the performance of the duties imposed upon it, and is not to be entertained. It necessarily follows that the provisions of the earlier act, in so far as they may seem to authorize the state board of health to maintain an action of the nature of the present one against a municipality operating a sewage disposal plant which has been constructed and is being operated pursuant to the consent and directions of the state sewerage commission, are repugnant to the provisions of the earlier act, and, in consequence, repealed to that extent at least. More than this it is unnecessary for me (Leaming, V. C.) to decide in this case, but I entertain the view that one legislative intent was to adopt an entirely new system for the protection of the public waters of the state and to substitute the provisions of the new act for those of the old originally designed for the same purposes, and that the later act operates to repeal the earlier act in its entirety."

In summary:

"1. The principle upon which subsequent legislation will operate to repeal prior legislation, without an express repealing clause, is, that where there are two acts on the same subject effect will be given to both, if possible. If the two acts are repugnant in any of their provisions, the later act operates to repeal the earlier to the extent of the repugnancy. Where two acts are not in express terms repugnant, if the later act covers the whole subject of the earlier act, and embraces new provisions, plainly showing that it was intended as a substitute for the earlier act, it will operate to repeal that act.

2. The provisions of Chapter 41 of the laws of 1899 (P. L. 1899 p. 73), authorizing the state board of health

to enjoin the pollution of potable waters, held to be repugnant to and repealed by Chapter 72 of the laws of 1900 (P. L. 1900 p. 113) in cases where the alleged pollution occurs by reason of the operation of a municipal sewer plant constructed and operated under and pursuant to the directions of the state sewerage commission appointed under the latter act.

3. Semble,[3] chapter 41 of the laws of 1899 (P. L. 1899 p. 73) is wholly repealed by Chapter 72 of the laws of 1900 (P. L. 1900 p. 113)."

The Borough of Vineland, therefore, was exempted from the provisions of An Act to secure the purity of the public supplies of potable waters in this State.

The decision in this case unquestionably restricted the enforcement of the law intended to prevent the pollution of streams used as sources of public potable water by sewage treatment plant effluents. But what was the opinion of the court relative to the discharge of polluting material other than that which is discharged from a legally constructed municipal sewage treatment plant?

The Court of Errors and Appeals decided, June 17, 1907, in The State, Ex Rel. The Board of Health of the State of New Jersey, respondent, v. George Ihnken, appellant, in part, as follows:

"The bill in this case was filed in the name of the state, on the relation of the state board of health, for an injunction to restrain the appellant, who was the defendant below, from permitting the waste water from the washing of cans and bottles, and the cleansing of the floors in his creamery near Stockholm in this state, to flow into and pollute a tributary of the Pequannock river from which the city of Newark obtains its supply of water for domestic use. The bill was filed pursuant to authority conferred upon the state board by the provisions of 'An Act to secure the purity of the public supplies of potable waters in this state', . . . upon the hearing in the court of chancery it was considered that the proofs made it clear that the defendant was engaged in polluting the waters of a tributary of the Pequannock river, about ten miles above the Newark intake, and that he was doing so within the prohibition of the

[3] Semble is defined as "an opinion in reference to the law on some point not necessary to be decided and not intended to be definitely settled in the cause."

act of the legislature just mentioned, as construed by the court of chancery. . . . It is argued before us, however, that the act of March 17, 1899,"—the Potable Water Act—"was repealed, by implication, by a subsequent statute passed in the same year"—the State Sewerage Act—"and that for this reason the decree appealed from should be reversed. . . . The state sewerage commission statute of 1899 was revised and amended by the legislature of 1900. P. L. 1900 p. 113. The amendments, however, made little change in the original statute, except by increasing the powers of the commission. . . . The conduct of the appellant which is made the ground of its action by the state board of health . . . is an act not placed within the cognizance of the state sewerage commission by the statute which created that body. The power to invoke the aid of the court of chancery to restrain such action, therefore, still remains with the state board of health. The decree appealed from should be affirmed."

In summary:

"1. So much of the act entitled 'An Act to secure the purity of the public supplies of potable waters in this state' (P. L. 1899 p. 73), as is repugnant to the provisions of the act entitled 'An Act to prevent the pollution of the waters of this state by the establishment of a state sewerage commission' (P. L. 1899 p. 536), is repealed by the latter act.

2. The power conferred upon the state board of health by the former of these statutes to invoke the aid of the court of chancery to restrain the discharge of waste water, from the washing of bottles and cans in a creamery and from the cleansing of its floors, into the tributary of a stream from which a municipality obtains its water supply, is not revoked by the latter statute."

From these two decisions it is readily concluded that the abatement of pollution of streams used for potable purposes was dependent upon two separate state agencies whose ambitions did not always lead in the same direction and in instances seriously conflicted to the detriment of safe water supplies in so far as the discharge of sewage treatment plant effluents were concerned.

In an act approved May 7, 1907 (Chapter 135, P. L. 1907), how-

ever, the State Sewerage Commission was granted additional powers, and, waters of this State were defined as follows: " 'Waters of this State', as used in this act and the act to which this is a supplement, shall include the ocean and its estuaries, all springs, streams, and bodies or surface or ground water, whether natural or artificial, within the boundaries of this state or subject to its jurisdiction."

In 1908, the powers and duties vested in the State Sewerage Commission were transferred to the Board of Health of the State of New Jersey (Chapter 297, P. L. 1908).

In April 21, 1909, there was approved a supplement (Chapter 253, P. L. 1909) to "An Act to secure the purity of the public supplies of potable waters in this State." The first paragraph of the supplement is as follows:

> "1. No person or corporation now or hereafter engaged in the distribution or sale of water for potable purposes shall deliver to any consumer any water which, in the opinion of the Board of Health of the State of New Jersey, is polluted, contaminated or impure, or which is obtained from any source which, in the opinion of the Board of Health of the State of New Jersey, is or may become polluted, contaminated or impure, unless purification by filtration, or other means acceptable to the Board of Health of the State of New Jersey shall be accomplished before such water is distributed."

The provisions of Chapter 253, P. L. 1909 are, in our opinion, the first legislative recognition, in New Jersey, of the fact that the safeness of a public water supply, derived from a surface source, could no longer be controlled, solely, through the sanitary restrictions placed upon the area of the watershed. It is concluded, in the matter of stream pollution, that the approval of this supplement of 1909 continued the restrictions upon those established upon the watersheds, and, set up new restrictions upon those supplying water, for potable and domestic purposes, from such sheds; thus placing part of the burden of supplying a safe water upon the water purveyor.

The Delaware River is one of the largest interstate streams used for sources of public water supplies in the State of New Jersey. The City of Burlington is the municipality farthest down stream that uses the Delaware River as a source of public water supply. A distinction is here made between an established source and an emergency source of water.

The legality of the act transferring the powers and duties of the State Sewerage Commission to the State Board of Health, and, the potency of the State Sewerage Commission or State Board of Health to function in the matter of the pollution of waters of the Delaware River, an interstate stream, have been ruled upon by the courts. Chancellor Walker, in his opinion (N. J. 85 Eq.—Decided January 30, 1909) in Chancery of New Jersey, in the matter of The Board of Health of the State of New Jersey, Complainant, and, The Inhabitants of the Town of Phillipsburg, Defendant, ruled, in part, as follows:

> "The town of Phillipsburg is located upon the east bank of the Delaware river within the state of New Jersey, which river is numbered among the waters of this state used for potable purposes by its citizens, and is subject to the jurisdiction of this state, as will presently be shown. . . . The city of Trenton and various other cities of this state are now using the waters of the Delaware river for potable purposes, supplying the same to their citizens, inhabitants of New Jersey, who, by reason of the pollution of the waters of that river . . . are suffering injury in their health, comfort and property, in that they are compelled to expend large sums of money to purify the waters of the Delaware for potable purposes, for the protection of their health, and to exercise unusual precaution to protect themselves from risk of disease arising from pollution of these waters. . . . The first defense levelled at the complainant's proceedings is that the state board of health, while endeavoring, has not the power to enforce the notice of the state sewerage commission. . . . The contention is that the attempt to transfer jurisdiction from the state sewerage commission to the state board of health was nugatory because not within the title of the supplement of April 16, 1908. With this contention I disagree. . . . The defendant contends that . . . the complainant is impotent to enforce the statute against it because the legislation in question does not extend to and comprehend the Delaware river. . . . It is idle for the defendant to ask of what avail it would be to stop the town of Phillipsburg from discharging its sewage in the Delaware, when the sewage of the city of Easton opposite, and the polluting flow of the Lehigh, are discharged into the same stream in the

same locality. . . . The result reached is that a mandatory injunction must issue in accordance with the prayer of the bill, to compel the town of Phillipsburg to cease its unlawful act of polluting the waters of the Delaware river by permitting sewage and other polluting matter to flow therein from its sewerage system and drains, and to make such disposal thereof as shall be approved by the state board of health."

The town of Phillipsburg appealed the decision of the Court of Chancery. The case was argued in the Court of Errors and Appeals on June 18, 1915, and decided Nov. 15, 1915. In summary, the latter court held:

"1. The title of the act of 1900 (P. L. 1900 p. 113: Comp. Stat. p. 5816) does not limit the scope of the legislation to the prevention of pollution of the state's water by means of a state sewerage commission.

2. The act of 1908 (P. L. 1908 p. 605; Comp. Stat. p. 5830) vesting in the state board of health the powers of the state sewerage commission, is constitutional."

And the opinion delivered by the court contains:

"We should think it unnecessary to add to what the chancellor said but for some suggestions in the brief in this court of council for the appellant, which seem to deserve remark," and, "The decree is affirmed. Costs should follow the decree. The defendants, instead of complying with the notice served in 1906, chose to litigate. We see no reason for making a distinction between a municipal corporation and an individual."

The powers and duties vested in the State Board of Health were transferred to the Department of Health in 1915 (Chapter 288, P. L. 1915).

In 1918, An Act to secure the purity of the public supplies of potable waters in this State was amended by Chapter 229 (Comp. Stat. Supp. p. 3815). The amendment set up additional powers in the supervision of the pollution of waters later used for public purposes. These powers, as well as the establishment of a new legislative policy in state waters, enter into the Conclusion in Chancery of New Jersey, decided May 9, 1919, between "The State of New Jersey at the relation of the Department of Health of the State of New Jersey, Complainant, vs. The Chemical Company of

America, Inc., Defendant." The conclusion of Backes, V. C. is, in part, as follows:

> "Those extenuating circumstances"—small volume of industrial wastes discharged into the Rahway river, and, the testimony upon the construction and operation of the city of Rahway's water filtration plant—"advanced by the defendant would be, perhaps, admissible if the cause were for the suppression of a common law nuisance, but as this suit is in aid of the police power of the state they are wholly beside the issue. The aim and policy of the legislature, as evinced by the statute, is to secure to populated communities wholesome drinking water; and, in vindicating the sovereign right of the State to the purity of its streams, it last year adopted a measure more emphatic than before by placing its ban upon specific contaminations and things in general that are polluting. As the act originally read it prohibited the discharge into, or depositing upon, the banks of, streams furnishing potable water to municipalities, of 'sewage, drainage, domestic or factory refuse, excremental or other polluting matter of any kind whatsoever which, either by itself or in connection with other matter, will corrupt or impair, or tend to corrupt or impair, the quality of the water of any river, brook, etc. or which will render, or tend to render, such water injurious to health'. This involved in every offense not only the fact that the prescribed foreign substances were being discharged into the streams, but also the determination by the courts that they corrupted or impaired or tended to corrupt or impair the quality of the water, or rendered or tended to render it injurious to health. . . . In the amendment of 1918 the legislature itself determined that factory refuse and the other mentioned wastes and castoffs are contaminating, and preemptorily forbade their discharge into streams and their deposit upon the banks thereof. The defendant is violating the law in both of these aspects. As has been pointed out there is drainage of the refuse into the streams, at least into one of them, and it is of no moment that it has not been or cannot be traced to spigots in Rahway. The pollution aimed at by the statute is at the point of discharge into the stream. . . . That statute condemns not only actual pollution, but pronounces as

> imperatively against the threat and menace of it upon the banks of the streams. . . . The legislative scheme to purify the streams of the state contemplates the exclusion of two avenues of corruption; that of direct discharge of polluting matter into the water, which necessarily includes depositing on the bank from which it is bound to fall or flow into the stream, and that of depositing it so near the banks as to constitute a threat or menace of ultimately reaching the water, contaminating it. How to give to the word 'banks' as used in the statute, a construction other than its popular significance—the immediate drainage region of lands contiguous to streams—would render the design of the second feature of the act wholly abortive. It would be playing with words and trifling with legislative mandate to hold that discharge of polluting matter on the bank anywhere below the brink would be violative of the statute, while a deposit on the land an inch away from the brink would not be. When Chancellor Walker had State vs. Town of Phillipsburg (83 N. J. E 9.422) under consideration, he seems to have had no doubt that garbage dumps on lands immediately adjacent to the bank of the Delaware River, the refuse of which in normal times by reason of the natural slope of the ground found its way into the waters of the river, and in case of freshets, was washed directly into the waters of the river, violated the provision of the act. The decision turned upon another ground, but it is significant that in that hotly contested case the point was passed *sub silentio.*"

The above quoted opinions, seem to define in explicit terms the meaning and scope of the laws relative to nature and extent of pollution. The costs involved in the abatement, although implied in the latter case, were not definitely discussed or decided. The opinion of the Court of Chancery, on December 15, 1923, in the Department of Health of the State of New Jersey, Complainant, vs. City of North Wildwood, Defendant, although it does not relate to the pollution of potable waters, is pertinent in clarifying the court's attitude in this type of defense. In this case the defendant asked leave to appeal from the finding and determination of the complainant. "Succinctly"—the defendant claimed—

"(b) That the cost of erecting a proper sewage disposal plant will be $300,000; (and in substance) that its bonded indebtedness is very close to the limit prescribed by law, and at no time has it been possible for it to pay for the erection of a proper plant by an issue of bonds, without exceeding this legal limit; although it has tried to reduce its bonded indebtedness by 'diligently attempting' to collect large arrearages of taxes and assessments; and that it will endeavor to have the legislature at the coming session raise the present limitation of its authorized bonded indebtedness.

Clearly, to my mind, there is nothing in any of this which constitutes a defence to the bill. The legislature has imposed upon defendant the obligation to do the very thing of which complainant prays this court to enforce the performance of and has provided that complainant may apply to this court for such enforcement. The mere fact that defendant cannot legally perform by means of issuing bonds does not show that it cannot legally perform at all. It has the taxing power wherewith to raise funds for the purpose; possibly also the power to do so by special assessment. There is not even a showing that the raising of the requisite sum of taxation would substantially increase its tax rate; although I do not mean to be understood that if such proof were made it would constitute any defence.

The complainant's objection that the answer discloses no defence must be sustained."

In summary:

"1. To a bill under P. L. 1907 ch. 135, by the state department of Health for injunction to compel such city to cease the pollution of waters of the state and to provide a proper means for disposal of its sewage, the fact that the bonded indebtedness of a city already equals the statutory limit thereof, does not constitute a defence.

2. The court of chancery has no power to entertain an appeal from the findings of the state sewage commission (now the state Department of Health) after the expiration of the time limited for such appeal in the statute."

The preceding outlines in general the legal powers and restrictions of the Department of Health of the State of New Jersey in the mat-

ter of abating pollution after it is found to exist. As may be conceived from the case Department of Health vs. Chemical Company of America, Inc., even though ignorance of the law or of the watershed is no defense, an economic hardship can be placed upon an industry which unknowingly establishes upon a watershed of a stream later used as a source of public potable water, particularly if the industry is of such a nature that a large volume of industrial waste is produced. On the other hand the abatement of a pollution, should court procedure be required, is a long, expensive and unpleasant undertaking for the enforcement agency, and the pollution itself, between the time it is discovered and the time eliminated, may and does imperil the quality of the water supply, and if not its safety at least its attractiveness.

Because of the economic hardship to the industry, the court procedure required under the "Potable Water Act", and the harm done to a water supply by pollution until the ruling of the courts caused the abatement, as was exemplified by the case The Department of Health vs. Chemical Company of America, Inc., the legislature in 1921 enacted a law (Chapter 280, P. L. of 1921) requiring that "factories, workshops or places for the manufacture of materials or goods hereafter established within the watershed of streams above the point at which public supplies of potable water are taken, shall obtain from the Department of Health of the state of New Jersey a permit to locate or establish such factories, workshops or places."

Although the expressed purpose of this act is to require the obtaining of a permit by a manufacturer prior to his establishing a factory upon a watershed, due to ignorance of the law or the nature of the watershed, very few requests for permits are received by the Department of Health prior to the establishment or initial steps in the establishment of factories or workshops. There have been a few requests, however, and one in particular in behalf of a large manufacturer, using chemicals, desirous of locating on the Delaware River above Trenton. After explaining the degree of treatment required by the Department of Health for all industrial wastes as well as sanitary wastes, this company abandoned its idea of establishing in New Jersey upon the Delaware River and made a similar request in New York State to locate on the same stream. Because of the coöperation of the Departments of Health in the two states, especially in the protection of the Delaware River, it is believed that

this chemical manufacturer will not locate his plant on the Delaware River. It may be stated here, that this one case is illustrative of others in that the large manufacturers, who are, most generally, the potentially greater sources of pollution, are less probable to establish a factory contrary to this law than the smaller industries because of efficient legal advice available to them.

The second section of Chapter 280, P. L. 1921, is as follows:

> "2. The application for permission to locate or establish such factory, workshop, or place for the manufacture of materials or goods, on any watershed shall be made in writing to the Department of Health of the State of New Jersey by the person or corporation desiring to establish and operate the same, on forms to be supplied by said department. Said department shall adopt rules and regulations setting forth the information required to be stated in such application, and such information shall be submitted to said department with all applications for permits, in order that said department may be fully informed as to the character and nature of any waste liquids or materials which may affect the quality of streams used as sources of water supply."

The remaining sections of this law provide for a penalty of not less than $100 nor more than $500 for each week's continuous violation of the first two sections, for Chancery Court proceedings to obtain an injunction, and to reserve the rights of persons damaged by the location of the factory.

Section 2, as quoted, outlines in a general way the procedure the Department of Health follows and must follow in the enforcement of this law. If the industry does not request the application form of its own volition, as soon as information is received to the effect that a factory is being established, a copy of the law, application forms and directions for filing the application are forwarded to the factory. Upon the receipt of the completed application, if the water department or company deriving water from the stream, the watershed to which the application applies, has been instrumental in having the application submitted, has indicated an interest in it or may be materially affected; a copy of the application is forwarded to the water department or company with the request that the department or company advise the Department of Health relative to its desires or attitude toward the issuance of the permit.

If the interested water purveyor has no objections to the establishment, a permit issues subject to certain provisions and conditions, all of which relate to the prevention of pollution, to abatement of accidental pollution immediately after it occurs or to inspection relative to pollution of the stream. If the water purveyor indicates no serious objections to the establishment but offers constructive recommendations to safeguard his water supply, after investigation, the permit is generally issued subject to additional conditions applicable to the particular establishment.

If the purveyor objects to the issuance of the permit due to the nature of the industry, a hearing before the Director of Health is given. At this hearing the water purveyor and the industry presents the arguments and suggestions. To date, the applicants for permits have agreed after the hearings to erect or install sufficient safeguards to the water supply, so as to warrant, in the opinion of the department, the issuance of permits to all applicants with the usual conditions and provisions and other conditions pertaining only to the specific industry. A copy of the permit when issued to the applicant is forwarded to the water purveyor.

If the same difficulty, though not legally upheld, is experienced in the enforcement of this law, as in "Potable Water Act"; namely, industries are established, or partially so, before they have been apprised of the law or the watershed, what is the real value of it? The benefit derived by the factory or industry by this law is that, by the time the permit is issued, the industry is fully aware of the fact that it is established upon a watershed of a stream which is used for potable purposes and can conduct itself accordingly. Should it become necessary to increase or enlarge plant facilities, consideration can be given to relocation of the plant or adequate protection to the stream to avert disastrous consequences following court procedure and/or consequent partial or total economic loss.

To the agency enforcing stream pollution laws and the water purveyor, in the writers' opinion, the value, next in importance to the actual prevention of pollution by denying the permit, lies in the fact that the industry itself states the conditions according to which it will operate. If, after the industry is established, it does not operate in accordance with these self-imposed conditions, it has little or no defense should prosecution ensue to enforce one of the pollution abatement laws. In addition, the Department of Health and the water purveyors are assisted to a great extent in the supervision of

watersheds by having records of the most probable sources of pollution.

SUMMARY

To summarize, the powers and duties of the Department of Health of the State of New Jersey in the matter of stream pollution and watershed supervision are basically derived from two laws of the State relating to the abatement of pollution adopted by the legislature of New Jersey in 1899 and subsequently supplemented and amended and one having for its purpose the prevention of pollution adopted in 1921 which latter act also aids in the enforcement of the former ones.

From experiences in the enforcement of these laws and from court decisions defining their various terms and policies of the agencies in which their enforcement was lodged, it is concluded,—

1. That to secure effective supervision in the sanitary condition of waters later used for public potable purposes, the control of such stream pollution should be lodged in that governmental agency which is charged with the supervision of the purity of the public water supplies.

2. That the powers and duties formerly vested in the State Sewerage Commission and the State Board of Health are now vested in the Department of Health.

3. That the waters of this State include the ocean and its estuaries, all springs, streams and bodies or surface or ground water, whether natural or artificial, within the boundaries of this State and subject to its jurisdiction and also extend to and comprehend the Delaware River.

4. That "An Act to secure the purity of the public supplies of potable waters in this State"—Chapter 41, P. L. 1899, as amended by Chapter 229, P. L. 1918—prohibits "the discharge of excremental matter, domestic, factory, workshop, mill or slaughter house refuse, creamery or cheese factory waste, garbage, dye stuff, coal tar, sawdust, tan bark or refuse from gas houses, or other polluting matter" into waters later used for public potable purposes; and, the placement of the aforesaid matters upon the banks of streams, the waters of which are later used for public potable purposes.

5. That in the aforementioned act the legislature of New Jersey specifically defines certain substances as polluting matter and by doing so endows the enforcement agency with police powers.

6. That the aforementioned act can be used, effectively, to maintain the present sanitary quality of the waters of the Delaware River —and improve such quality—from the upper reach of the river to Burlington, New Jersey; waters, which are part of the territory now receiving consideration by the Interstate Commission on the Delaware River Basin.

7. That the statutory limitation in the bonded indebtedness of a municipality does not constitute a defense in the matter of the abatement of stream pollution.

8. That Chapter 280, P. L. of 1921 is an act, in contrast to the abovementioned two acts relating to abatement, designed to prevent pollution—distinguishing between abatement and prevention.

9. That the procedure involved in the enforcement of Chapter 280, P. L. of 1921, ameliorates the enforcement of the other stream pollution laws.

THE DETECTION AND DETERMINATION OF CYANIDES IN WATER*

By Robert A. Greene and Edward L. Breazeale

(Arizona State Laboratory, Tucson, Arizona)

INTRODUCTION

The Arizona State Laboratory is charged with the examination of the water supplies of the state. From time to time there have been reported cases of livestock poisoning, presumably due to the pollution of streams by tailings or wastes from mines which employed the cyanide process.

When we were called upon to determine whether or not streams were polluted with cyanides, a survey of the most common texts did not reveal any satisfactory methods of analysis. The only test mentioned was the phenolphthalin test which was described by Theroux, Eldridge and Mallman (13).

This paper will give our experience with several tests and will also suggest qualitative and quantitative procedures.

EXPERIMENTAL

A stock solution of potassium cyanide was prepared by dissolving approximately one gram of the reagent in 100 ml. of distilled water. The solution was analyzed, using the method given by the *U. S. Pharmacopoeia XI* (10) for the assay of sodium cyanide. The solution was adjusted so that 1 ml. contained 10 mgs. of KCN. Dilutions were prepared from this stock solution.

Varying amounts of KCN were added to tap water and the several tests which were employed were made upon these dilutions. The tap water had the following composition:

Total Soluble Salts	298
Calcium	16
Magnesium	23
Sodium	17

* Contributed record of research.

Chlorides	26
Sulphates	40
Carbonates	0
Bicarbonates	176
pH	7.4

QUALITATIVE TESTS

An excellent discussion of the common qualitative tests for cyanides are given by Webster (14), and Engelder (4). The tests which were employed and the chemical reactions involved are so well known that any discussion seems unnecessary.

Since it is common practice to add ferrous sulphate to the cyanide liquors in order to convert them to ferrocyanides, all tests were carried out in the presence of relatively large amounts (roughly 10 times) of ferro and ferricyanides.

I. Phenolphthalin Test. This is described in detail by Theroux, Eldridge and Mallman (13). One ml. of phenolphthalin (not phenolphthalein) solution (0.5 gm. in 150 ml. of distilled water containing 1 gm. NaOH) and 0.5 ml. of copper sulphate solution (0.05 percent) are placed in each of two test tubes. Fifteen ml. of the sample are added to one tube and 15 ml. of freshly boiled and cooled distilled water are added to the other. The immediate development of a pink color shows the presence of cyanides. This color sometimes develops in distilled water upon standing due to the oxidation of phenolphthalin to phenolphthalein. This test is not entirely specific for cyanides as chlorine and some other oxidizing agents give the same test.

Potassium ferricyanide gives a positive reaction; potassium ferrocyanide does not. The presence of potassium ferrocyanide inhibits the development of the pink color.

This test is quite sensitive. We have been able to detect as little as 0.3 ppm. of KCN.

II. Prussian Blue Test. This was carried out as directed by Engelder. 5 ml. of the KCN solution were placed in a test tube. One drop of NaOH solution (25 percent) and one drop of freshly prepared ferrous sulphate solution (10 percent) are added. The solution is heated to boiling, acidified with HCl, and then one drop of $FeCl_3$ solution (10 percent) is added. The development of a blue precipitate or greenish-blue color indicates the presence of cyanides.

Ferrocyanides give this test. Webster (14) states "This test is said to show hydrocyanic acid in a dilution of 1:50,000." We have not been able to detect less than 1 mg. KCN, using 5 cc. of sample.

As a routine procedure, in order to detect 10 ppm. of KCN it would be necessary to evaporate 100 ml. of sample (made slightly alkaline with NaOH) to a volume of 5 ml. If smaller amounts of KCN are suspected, a larger sample should be evaporated.

III. Sulphocyanate Test. 25 or 50 ml. of the sample are evaporated to dryness on a steam bath with 1–2 ml. of yellow ammonium sulphide until no more H_2S is evolved. The residue is taken up in a small amount of water and filtered. A few drops of dilute $FeCl_3$ solution are added. The development of the characteristic red color indicates the presence of cyanides. If necessary, the solution may be acidified (prior to adding the $FeCl_3$) with HCl and warmed gently, in order to facilitate the removal of sulphur. Avoid overheating since HCNS might be volatilized.

Ferrocyanides interfere with this test, by forming ferric ferrocyanide (Prussian Blue). Webster (14) states "This test . . . is very delicate, indicating hydrocyanic acid when present to the extent of 1:4,000,000." We have not been able satisfactorily to detect less than 0.3 mg. of KCN. For waters containing 10 ppm. of KCN, 50 ml. should be evaporated; if the KCN content is greater or less, vary the sample accordingly.

IV. Picrate Test. Guignard (6). Prepare picrate paper by dipping strips of filter paper into a saturated aqueous solution of picric acid and dry. Then, dip in solution of 10 percent Na_2CO_3, and dry again. Place a drop of the solution to be tested on a strip of paper and allow to dry. The development of a brick red color indicates the presence of cyanides.

This test is not specific for cyanides. The red color, which is due to the reduction of sodium picrate to sodium picramate (Morrow (7)), may be caused by other substances. Using this technic, we were not able to detect KCN satisfactorily when the concentration was less than 2 mg. per ml.

Potassium ferrocyanide and ferricyanide do not give a positive test, but the presence of relatively large amounts of ferricyanides inhibits the development of the color.

V. Silver Iodide Test. Fox (5). This test has given very satisfactory results, is very sensitive and highly specific, and is the test we recommend for routine use.

In a small test tube, place one drop of 5 percent KI solution, then add one drop of 0.001 M $AgNO_3$ and 1 ml. of 5 percent KOH solution. The sample is placed in a flask of suitable size, then acidified with a tartaric acid solution and connected to the test tube. The HCN is

aspirated into the opalescent suspension of AgI. If cyanides are present, the KCN which is formed in the test tube dissolves the AgI, rendering the solution perfectly clear. The sensitivity may be increased by using 0.00025 M $AgNO_3$. Fox (5) claims that under ordinary laboratory conditions, using the more dilute $AgNO_3$, the test will detect 1 part of HCN in 2,000,000.

Ferro and ferricyanides do not interfere with this test, nor do they give positive tests. At room temperature, and with the solution acidified with tartaric acid, we have not been able to detect any decomposition of ferro or ferricyanides with the production of HCN.

Using a sample of 250 ml. and 0.001 M $AgNO_3$ we have been able to detect 0.5 mg. of KCN (2 ppm.) satisfactorily.

QUANTITATIVE TESTS

For the past few years, the senior author has been an Associate Referee of the Association of Official Agricultural Chemists for the determination of hydrocyanic acid in glucoside bearing materials. In this time, several methods have been employed, but the most promising has been an alkaline titration method, which is essentially the method of Sharwood (12) and which is discussed by Blasdale (3).

The sample which contains cyanides is made ammoniacal, a few drops of KI solution are added and the cyanides are titrated with $AgNO_3$. The end point is the appearance of an opalescence, due to the formation of AgI.

Cyanides in water may be separated by making the sample slightly acid with tartaric acid and steam distilling into a dilute solution of NaOH. There is the possibility, however, of some decomposition of ferro and ferricyanides. We have found that steam distillation is not usually necessary, and that cyanides may be titrated directly. The following method (1) has given satisfactory results:

Place 100 ml. of the water to be tested in a beaker (preferable tall form). Add 8 ml. of 6 N NH_4OH and 2 ml. of 5 percent KI. Titrate with 0.02 N $AgNO_3$, using a micro-buret. The $AgNO_3$ must be added slowly and with constant stirring. The end point is a faint, but permanent, turbidity, which may be easily recognized, especially against a black background, or when the beaker is illuminated from the side by a beam of light which passes through obliquely. 1 ml. 0.02 N $AgNO_3$ equals 1.08 mg. HCN or 2.604 mg. KCN. If photo-electric equipment is available, this titration may be carried out by the method of Bartholomew and Raby (2). The only precautions

to be observed are: (1) do not use a larger sample than 100 ml., (2) add the $AgNO_3$ slowly and with constant stirring.

If calcium salts precipitate when the ammonia is added, the precipitate may be filtered off, without impairing the accuracy of the determination. Or, ammonium chloride may be added to prevent the precipitation of calcium and magnesium, as Sharwood (12) has suggested. When the calcium content is low, filtration is unnecessary. Although there is a slight turbidity, the opalescence of the AgI is quite distinctive and easily recognized. A slight error is introduced, particularly when small amounts of cyanides are present. Ferro and ferricyanides do not interfere with this determination.

The following table shows the results of the direct titration of KCN, which had been added in varying amounts to a water containing 16 ppm. of calcium and 23 ppm. of magnesium. Although the agreement is not perfect in all cases, especially when the amounts of cyanide are small, the results are, in general, within acceptable limits.

Recovery of potassium cyanide added to water

KCN ADDED	0.02 N $AgNO_3$	KCN RECOVERED		DIFFERENCE
mg.	*ml.*	*mg.*		*mg.*
0.33	0.15	0.39	0.41	plus 0.08
0.33	0.17	0.44		
0.82	0.35	0.91	0.93	plus 0.11
0.82	0.37	0.96		
0.98	0.40	1.04		
1.64	0.67	1.74	1.71	plus 0.07
1.64	0.65	1.69		
2.95	1.1	2.86	2.86	minus 0.09
	1.1	2.86		
3.28	1.27	3.30	3.29	plus 0.01
3.28	1.26	3.28		
4.92	1.87	4.87	4.86	minus 0.06
4.92	1.86	4.84		
8.20	3.14	8.18	8.19	minus 0.01
8.20	3.15	8.20		
9.83	3.79	9.88		plus 0.05

HOW MUCH CYANIDE SHOULD BE PERMITTED IN WATER?

Although water should not contain any cyanide, the question arises as to how much cyanide might be present in water without constituting a serious menace to health. The toxicity of cyanides is well known, but probably has been over emphasized. The effects of cyanides vary with the individual and, in the cases of water, with the amount of water consumed.

Webster (14) states "It is probable that the average lethal dose of hydrocyanic acid taken by mouth is about 60 cg. (1 grain), which corresponds to about . . . 0.154 gram (2.4 grain) of potassium cyanide. . . . Potassium cyanide has caused death in doses of 0.13 gram (2 grains), while doses as large as 3.25 grams (50 grains) have been recovered from."

The older editions of the *U. S. Pharmacopoeia VIII* (9) gave the average dose of potassium cyanide as 0.010 grams. *Merck's Index* (8) gives the maximum dose of potassium cyanide as 30 milligrams, if taken as a single dose, or 100 milligrams per day in a series of doses. The lethal dose for horses is given as 4–8 grams, and for dogs, 250 to 500 milligrams.

Assuming that the average daily water requirement of humans is 2400–2700 ml., of horses 7–10 gallons—(Rosenau (11))—and that the average maximum single water intake of humans is approximately 500 ml., it would appear that a person might use, for a short time, a water containing as much as 60 ppm. of KCN without any injurious effects. In order to secure enough cyanide to cause death of a horse, the water would probably have to contain between 150–200 ppm. of KCN.

Although it is admitted that waters should not contain any cyanides, it would seem that an allowance of 10 ppm. of KCN in exceptional cases where it may occur intermittently, should allow an ample margin of safety. This amount may be readily detected and determined.

SUMMARY

Several of the most common methods for the determination of cyanides have been tested and their sensitivity and sources of error have been discussed.

The silver iodide method of Fox has been the most satisfactory qualitative test.

A quantitative method is described for the direct determination of soluble cyanides.

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METHANE IN GROUND WATERS*

By A. M. Buswell[1] and T. E. Larson[2]

Methane has been occasionally observed for many years in water wells in Illinois and its source has been held to be the decay of organic matter, principally vegetable, in glacial drift or similar formations. The absence of detectable amounts of ethane or higher hydrocarbons is in contrast to "natural gas" composition and the occurrence of methane in water wells shows little if any relation to the occurrence of oil and natural gas. The amount of water well gas has usually been insignificant, sometimes being used in a limited way for household consumption and occasionally causing difficulty in pumping, the liberation of the gas on reduction in pressure breaking the suction of the pump.

Recently, however, a number of more or less serious explosions have occurred as the result of pumping water from such wells into a more or less enclosed reservoir or to lack of ventilation in the pump housing. As a result of these accidents this laboratory was asked to coöperate with the Departments of Public Health, and Mines and Minerals in a study of the general situation. The task assigned this laboratory was the collection of data on the location of methane-bearing water wells and the amount of methane present in such waters.

A search of the literature failed to reveal any analytical test for methane which was applicable to the substance in solution. The only course open was to collect a sample under pressure if possible and then boil out the gas as was done by Birge and Juday (1) and many of the other early workers in studies of dissolved oxygen. The gas thus displaced could be examined by the usual gasometric methods. Since most natural well waters carry at least 25 cc. per liter of dissolved gases (usually nitrogen and carbon dioxide) it appeared that a 4 liter sample would furnish the 100 cc. necessary for gas analysis.

The sampler shown in figure I consists of a tin-plated gallon milk

* Contributed record of research.

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can with inlet (extending to the bottom) and outlet tubes soldered directly to the top, the latter being soldered air-tight to the body. Quarter-inch brass valves are joined to each tube. The sampler was tested to withstand fifteen pounds per square inch internal pressure.

Samples were collected directly from the well if possible, and two or three volumes of water were passed through the container completely displacing the air before closing the two valves. Heating the sample to boiling expels the dissolved gases and part of the half-bound CO_2, all of which are collected over a saturated sodium sulfate solution in 15 per cent sulfuric acid. After the gas sample has cooled

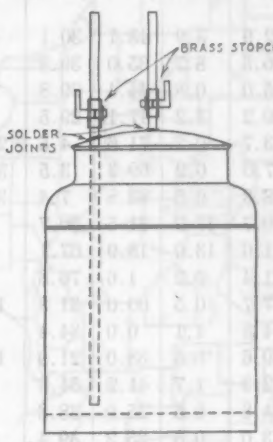

FIGURE 1
SAMPLER FOR WATER-DISSOLVED GAS DETERMINATIONS

to room temperature the total volume of gas is measured and an analysis is made for carbon dioxide, oxygen, and combustible gases with a Burrell apparatus. Typical analyses are listed in table 1. Carbon dioxide includes part of the bicarbonates as well as the free CO_2 present in the water.

From the table it will be noted that the amount of methane ranges as high as 11.6 cu. ft. per thousand gallons in which case it constituted 96 per cent of the total gas. The oxygen is attributed to sampling and experimental error although in a few instances a small amount of oxygen appeared to be actually dissolved in the well water. The length of time of pumping has an effect on the methane content. Samples (Nos. 24 to 28) collected at two hour intervals from the same well showed the methane content to decrease 25 per

cent after six hours pumping. There is also some evidence that the age of the well, the rate of pumping, and the barometric pressure may effect the methane content of a particular well water.

TABLE 1

Dissolved gas in ground water—Typical determinations

NUMBER	VOLUME OF WATER COLLECTED	VOLUME OF GAS* EXPELLED	ANALYSIS				FREE GAS			
			CO_2	O_2	CH_4	N_2	CH_4*	N_2	CH_4*	Total gas*
	cc.	cc.	percent	percent	percent	percent	cc.	cc.	cu. ft. per 1000 gal.	cu. ft. per 1000 gal.
1	2,160	105	22.9	3.9	43.1	30.1	46	16	2.8	3.8
2	2,200	210	16.5	8.7	35.0	39.8	70	12	4.3	5.0
3	2,190	170	25.0	0.8	44.4	29.8	76	21	4.6	5.9
4	2,150	170	20.2	3.2	47.1	29.5	63	23	4.0	5.4
5	4,310	285	23.7	0.2	71.6	4.5	204	11	6.3	6.7
6	4,330	545	27.0	0.2	69.3	3.5	378	15	11.6	12.1
7	4,350	375	8.3	0.5	83.8	7.4	352	23	10.8	11.5
8	4,320	120	0.7	17.2	31.5	50.7	38		1.2	
9	4,320	100	1.0	13.0	18.9	67.1	19		0.6	
10	4,350	113	21.4	0.2	1.6	76.8	2	86	0.1	2.7
11	4,320	261	7.7	0.5	60.0	31.8	157	78	4.9	7.3
12	4,310	107	14.5	1.1	0.0	84.4	0	86	0.0	2.7
13	4,330	485	39.6	0.5	38.0	21.9	184	97	5.7	8.7
14	4,330	196	2.3	1.7	41.2	54.8	81	95	2.5	5.4
15	4,350	215	34.8	0.5	25.9	38.8	56	78	1.7	4.2
16	4,350	208	73.0	0.5	25.2	39.4	52	77	1.6	4.0
17	4,330	188	76.0	1.0	8.7	49.6	16	86	0.5	3.1
18	4,310	233	20.9	3.6	20.2	55.3	47	96	1.5	4.4
19	4,310	206	25.1	2.0	22.7	50.2	47	87	1.5	4.2
20	4,330	228	39.4	0.8	23.8	36.0	54	73	1.7	3.9
21	4,320	203	29.2	0.5	32.2	48.1	65	73	2.0	4.3
22	4,350	165	40.0	13.2	8.2	37.4	13		0.4	
23	4,320	205	46.6	11.2	5.9	36.3	12		0.4	
24	4,310	158	13.4	2.0	29.8	54.8	47		1.5	
25	4,320	162	28.9	2.8	25.2	43.1	41		1.3	
26	4,320	158	25.2	3.9	23.5	47.4	37		1.1	
27	4,330	156	31.4	3.4	22.2	43.0	35		1.1	
28	4,330	150	26.0	3.3	22.7	48.0	34		1.0	
29	4,320	262	23.2	0.9	73.7	2.2	194		6.0	
30	4,320	173	19.1	0.8	41.8	38.3	72		2.2	

* Gas volume at 77°F.

Some analyses on aerated water (Nos. 8, 9, 22, 23) have shown methane to persist in small quantities. Since it is known that

methane forms insoluble hydrates under high pressures (2) there must be some chemical affinity between methane and water slight as it may be, even at normal temperature and pressure. It is to be expected that the removal of the final traces would be somewhat more difficult than removal of an inert gas.

In addition to analyses made in connection with this particular study a search was made through records of about 50,000 wells col-

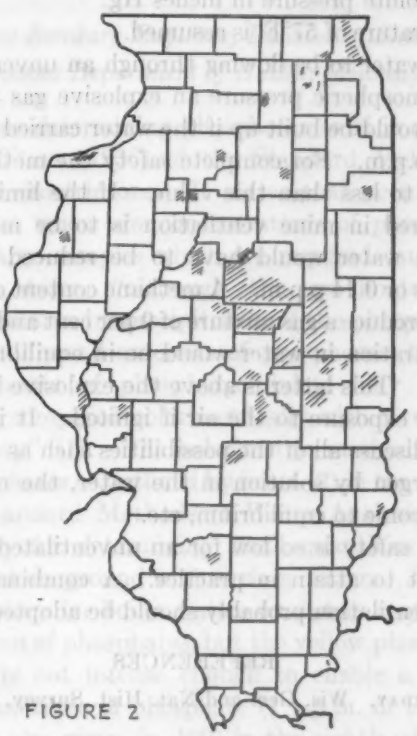

FIGURE 2

AREAS IN ILLINOIS WHERE METHANE HAS BEEN FOUND IN GROUND WATERS

lected as a C.W.A. project. This project covered about 35 per cent of the State. Although the question of methane was not included in the questionnaire used in making the survey, the records indicated its presence in wells in 18 localities by the shaded area in figure II. There is no doubt that other areas may be equally noteworthy.

The question of greatest practical interest in this connection is the safe limit of methane content or the value to which it must be reduced to insure safety from explosions at all times. It is known (3) that

mixtures of methane and air of from 5 percent to 15 percent methane content are explosive and that below this limit the mixture will not burn. The solubility of methane from various gas mixtures is also known (4). From these data one can calculate the desired value from the formula

$$\text{Percent } CH_4 \text{ in air at equilibrium} = \frac{542}{P} \times Q$$

where Q = cu. ft. CH_4/1000 gallons and

P = absolute pressure in inches Hg.

A temperature of 57°F. is assumed.

Assuming the water to be flowing through an unventilated air-tight chamber at atmospheric pressure an explosive gas mixture of 5 per cent methane would be built up if the water carried 0.28 cu. ft./1000 gallons or 1.4 p.p.m. For complete safety the methane would have to be removed to less than this value. If the limit of 0.5 per cent methane required in mine ventilation is to be met, the methane content of the water would have to be reduced below 0.028 cu. ft./1000 gallons or 0.14 p.p.m. A methane content of 0.5 cu. ft./1000 gallons would produce a gas mixture of 9 per cent and 0.83 cu. ft./1000 gallons concentration in water would be in equilibrium with 15 per cent in the air. This latter is above the explosive limit and the gas would burn on exposure to the air if ignited. It is impossible in a brief space to discuss all of the possibilities such as the effect of slow removal of oxygen by solution in the water, the rate at which the water and gas come to equilibrium, etc.

The limit of safety is so low for an unventilated chamber that it will be difficult to attain in practice. A combination of methane removal and ventilation probably should be adopted.

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THE DETERMINATION OF PHOSPHATES IN NATURAL WATERS*

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The method for determining phosphates as it is outlined (p. 86) in the eighth edition (1936) of the Standard Methods of Water Analysis is a gravimetric one. It states that accurate results are obtained but that when low concentrations of phosphates are encountered, the large samples which are required cause some inconvenience. Snell states, "although the gravimetric method of analysis for phosphorus by precipitation of the phosphomolybdate is very inaccurate for small amounts of phosphorus, the solutions of these small amounts of phosphomolybdate may be determined titrimetrically or compared colorimetrically with a very satisfactory degree of accuracy" (1). The colorimetric method for the determination of phosphates as outlined by Scott (2) in the seventh edition (1933) of the Standard Methods of Water Analysis has not been found satisfactory for determining small quantities of phosphates such as are found in ground and surface waters. Scott's method would be satisfactory for boiler waters or waters containing at least one part per million of phosphates, but the yellow phosphomolybdate color developed is not intense enough to enable a differentiation between small quantities of phosphate (1 p.p.m. or less). A colorimetric method is also given (p. 109) in the eighth edition (1936) of the Standard Methods of Water Analysis, but it is given in the section on Stationary Boiler Waters. It states that this method may be employed in routine analysis of boiler water for control purposes where results within about three parts per million of the correct amount are satisfactory. The aminonaphthol sulfonic acid solution used for reducing the phosphomolybdate has to be very pure and has to be made up fresh at least every two weeks. The Deniges colori-

* Contributed record of research.

metric method (3) depends on the extremely sensitive blue color reaction that occurs when the molybdate of phosphorus or arsenic is reduced with stannous chloride under suitable conditions.

Different investigators have developed methods along similar lines but employing different reducing agents such as phenylhydrazine (4), benzidine (5, 6, 7), gallic acid (8), hydriodic acid (9), sodium thiosulfate (10), hydroquinone (11), 1,2,4-aminonaphthol sulfonic acid (12), reduced molybdic acid (13) and hydrazine sulfate (14). However, it appears that stannous chloride as it is utilized by Deniges is far superior to the other reducing agents suggested for this purpose. Slight modifications have been made in the procedure, but the one presented by Robinson and Kemmerer (15) has proven to be the most satisfactory. The method of Truog and Meyer (16) was almost as suitable but no satisfactory results could be obtained with the modification of Farber and Youngberg (17). The difficulty with the latter seemed to be in the concentration of reagents used. In using the Robinson and Kemmerer method differences of 0.0001 mg. of phosphorus could be estimated in the lower concentrations and as small a quantity as 0.0002 mg. of phosphorus could easily be detected. This method, however, was not found applicable in determining quantities of phosphorus greater than 0.025 mg. or 0.5 p.p.m. of phosphorus in 50 ml. of sample.

The Deniges or ceruleomolybdate method is a colorimetric one whereby phosphomolybdate is reduced by stannous chloride to give an intense blue color. Phosphomolybdic acid is much more sensitive to reducing agents than molybdic acid, the reduction being localized in one or two atoms of the complex (18). The blue product which results is a negative colloid obtained only in acid solution. It also exists as a crystalloid. The hydrogel has the formula Mo_3O_8, H_2O (19). Deniges (3) introduced stannous chloride as a reducing agent under conditions which reduced only the phosphomolybdate. This reagent has been greatly improved and is probably the best reducing agent for the purpose. Six mols of stannous chloride per mol of phosphorus pentoxide are necessary. Six of the twelve molybdenum atoms are reducible.

An ammonium or sodium molybdate sulfuric acid solution is added to the unknown solution forming ammonium phosphomolybdate but because of the high dilution a precipitate is not apparent. A few drops of stannous chloride are then added causing a reduction of the molybdenum which is in combination with the phosphate but not of

that added in the excess of ammonium molybdate reagent. However, if the acidity is too low the ammonium molybdate will give of itself an intense blue color when stannous chloride is added. On the other hand, if the acidity is too high, a blue color is not produced even if phosphates are present, probably because ammonium phosphomolybdate is not formed at the high acidity. In other words, stannous chloride easily reduces molybdenum in combination as a salt such as ammonium molybdate or ammonium phosphomolybdate but will not reduce the molybdenum which exists as the free acid.

Using the proper amount of reagents, no trouble is encountered with interfering substances in surface and ground water. Aluminum and manganous salts in considerable amounts, nitrate in an amount equivalent to 100 p.p.m. nitrogen, calcium and magnesium salts in amounts up to at least the equivalent of 1,000 p.p.m. of CaO or MgO, titanium up to 20 p.p.m. titanium oxide and silica not in excess of 700 p.p.m. may be present without influencing the color (16). As much as 3,000 p.p.m. of sulfates may be present without causing interference. Ferric iron in excess of 6 p.p.m. causes an off color but may be reduced to the ferrous form which has no effect up to about fifty times as much iron as phosphate (16).

When the sample contains organic matter and silt, it must be digested with acid to put all of the phosphates into solution. The phosphorus which is found in the untreated sample of water is called the soluble or phosphate phosphorus and the result obtained after treating the sample with oxidizing agents represents the total phosphorus (20). Deducting the soluble phosphorus from the total phosphorus gives the so called organic phosphorus. The latter may include a small amount of inorganic phosphorus which becomes available on digesting the silt present in the sample. It is important that the soluble phosphate determination be made immediately after the collection of samples because the organic materials slowly decompose and the organic phosphates are analyzed as soluble phosphates.

Sulfuric and nitric acids are used to oxidize the organic matter rendering it soluble in water. Titus and Meloche (21) ran a series of digestions using these two acids to oxidize the organic material and found that quite a range of temperatures could be used without loss of phosphorus. They suggest digestion at 170–180°C. for ten minutes in an air bath but this procedure necessitates extra equipment and careful temperature control. The procedure recommended by Robinson and Kemmerer for digestion was found to be more

satisfactory and simpler. The concentrated sample is placed in a 50 ml. Erlenmeyer flask and 2 ml. of 3.6 N H_2SO_4, 0.5 ml. conc. HNO_3 and 3 ml. of conc. HCl added. The flask is then placed on a hot plate

TABLE 1

Influence of hydrogen ion concentration on intensity of blue color produced by phosphate

ML. STANDARD PO_4 SOLUTION, 1 ML. = 0.01 MG. P.	P.P.M. OF P IN STANDARD	ML. 3.6 N H_2SO_4 CONTAINED IN 50 ML. STANDARD	OBSERVED READING AS COMPARED TO UNTREATED STANDARDS, P.P.M. P
0.2	0.04	0.2	0.037
0.2	0.04	0.4	0.035
0.2	0.04	0.6	0.032
0.2	0.04	0.8	0.030
0.2	0.04	1.0	0.028
0.2	0.04	1.5	0.025
0.4	0.08	0.2	0.078
0.4	0.08	0.4	0.076
0.4	0.08	0.6	0.074
0.4	0.08	0.8	0.072
0.4	0.08	1.0	0.070
0.4	0.08	1.5	0.064
0.6	0.12	0.2	0.118
0.6	0.12	0.4	0.116
0.6	0.12	0.6	0.114
0.6	0.12	0.8	0.112
0.6	0.12	1.0	0.110
0.6	0.12	1.5	0.096
0.8	0.16	0.2	0.158
0.8	0.16	0.4	0.156
0.8	0.16	0.6	0.154
0.8	0.16	0.8	0.152
0.8	0.16	1.0	0.150
0.8	0.16	1.5	0.146
1.0	0.20	0.2	0.198
1.0	0.20	0.4	0.196
1.0	0.20	0.6	0.194
1.0	0.20	0.8	0.192
1.0	0.20	1.0	0.192
1.0	0.20	1.5	0.184

and slowly heated until the dense white fumes of SO_3 start to form. The temperature at which this volatilization takes place varies but is approximately 165–180°C. There is no danger of losing any phosphorus at this temperature. The author has found that the digestion

can be carried out very satisfactorily in a small balloon flask. The residue and acid remain intimately in contact with each other and there is no danger of loss on spattering. It is advisable to use more than 2 ml. of 3.6 N H_2SO_4, in order to prevent charring and drying out of the residue.

The final acid concentration of the sample is an important factor in the determination because the blue color developed is sensitive to different hydrogen ion concentrations. A series of standard phosphate solutions were treated with 3.6 N H_2SO_4 and compared with untreated standards. The results are given in table 1, the color comparisons being made in 50 ml. Nessler tubes.

TABLE 2

Influence of ammonium sulfate and sodium sulfate on the blue color in the colorimetric determination of phosphorus

UNTREATED STANDARDS		STANDARDS CONTAINING VARYING QUANTITIES OF $(NH_4)SO_4$		STANDARDS CONTAINING VARYING QUANTITIES OF Na_2SO_4	
Ml. standard $PO_4^{\equiv}$ solution, 1 ml. = 0.01 mg. P	p.p.m. of P	Ml. $(NH_4)SO_4$ solution, 1 ml. = 10 mg. $SO_4^{\equiv}$	Observed reading as compared to untreated standards, p.p.m. P	Ml. Na_2SO_4 solution, 1 ml. = 10 mg. $SO_4^{\equiv}$	Observed reading as compared to untreated standards
0.1	0.02	6.9	0.02	6.9	0.02
0.1	0.02	10.0	0.02	10.0	0.02
0.1	0.02	15.0	0.02	15.0	0.02
0.5	0.10	6.91	0.10	6.91	0.10
0.5	0.10	10	0.10	10.0	0.10
0.5	0.10	15	0.10	15	0.10
1.0	0.20	6.91	0.20	6.91	0.20
1.0	0.20	10	0.20	10.0	0.20
1.0	0.20	15.0	0.20	15.0	0.20

In order to prove that the fading in the color of the blue standards was due to the hydrogen ion concentration and not to the sulfate radicle, a series of standards were treated with solutions of ammonium sulfate and sodium sulfate. The sulfate solutions were made up to such concentrations that 1 ml. of each was equivalent to 10 mg. $SO_4^{\equiv}$. The results are given in table 2 and show that $SO_4^{\equiv}$ concentrations up to 3,000 p.p.m. have no effect on the color of the phosphate compound.

The acid in the samples can be neutralized with alkali using phenolphthalein to determine the end point and the fading effect on

the blue color is thus eliminated. Standards were treated with H_2SO_4, the acid neutralized with NaOH and comparisons made with untreated standards. The results are given in table 3.

Thus if the acid concentration of the sample after digestion is known, colorimetric comparisons can easily be made with standard solutions. The digested sample is diluted up to a definite volume and an aliquot portion is titrated with standard alkali using phenolphthalein as an indicator. Then another aliquot portion is treated with an amount of alkali equivalent to the acid present and a direct colorimetric comparison is made with standards.

TABLE 3

Elimination of effect of acid on blue phosphate color—neutralization with alkali

ML. STANDARD PO_4 SOLUTION	P.P.M. OF P	ML. 3.6 N H_2SO_4	ML. 0.991 N NaOH	OBSERVED READING AS COMPARED WITH UNTREATED STANDARDS, P.P.M. P
0.1	0.02	0.5	1.82	0.02
0.1	0.02	1.0	3.63	0.02
0.5	0.10	0.5	1.82	0.10
0.5	0.10	1.0	3.63	0.10
1.0	0.20	0.50	1.82	0.20
1.0	0.20	1.0	3.63	0.20

REAGENTS REQUIRED

1. Molybdate reagent: 10 gms. ammonium molybdate dissolved in 100 ml. distilled water. This solution is added to 300 ml. 50 percent (by vol.) H_2SO_4. It is necessary to protect this solution from the light.

2. Stannous chloride: Dissolve 1.9 gms. $SnCl_2 \cdot 2H_2O$ in 20 ml. conc. HCl and add two drops of 5 percent $CuSO_4$ solution. Dilute to 100 ml. and add a piece of clean tin to keep the stannous chloride in a reduced state.

3. Standard Phosphate Solution: Dissolve 4.394 gms. anhydrous KH_2PO_4 in distilled water and dilute to one liter. One ml. of this solution is equivalent to 1 mgm. P. Solutions containing 0.01 mgm. and 0.001 mgm. P per ml. are made from this stock solution by appropriate dilutions.

PROCEDURE

For determining concentrations of 0.5 p.p.m. or less phosphorus:

1. Soluble phosphorus. Concentrate enough sample in an Erlen-

TABLE 4

Results of total phosphorus determinations on the seven samples, A, B, C, D, E, F, G

ORIGINAL VOLUME OF SAMPLE	VOLUME OF ALIQUOT PORTION USED FOR COLOR COMPARISON	RESULTS IN P.P.M. P WHEN ALIQUOT PORTION WAS NEUTRALIZED	RESULTS IN P.P.M. P WHEN ALIQUOT PORTION WAS NOT NEUTRALIZED
Sample A			
100 ml.	50 ml.	0.350	0.330
100 ml.	50 ml.	0.350	0.330
250 ml.	25 ml.	0.348	0.328
250 ml.	25 ml.	0.348	0.328
250 ml.	25 ml.	0.348	0.328
250 ml.	25 ml.	0.348	0.328
250 ml.	25 ml.	0.348	0.332
250 ml.	25 ml.	0.348	0.336
Sample B			
100 ml.	50 ml.	0.265	0.240
100 ml.	50 ml.	0.265	0.240
250 ml.	25 ml.	0.268	0.260
250 ml.	25 ml.	0.268	0.260
Sample C			
200 ml.	25 ml.	0.110	0.100
400 ml.	25 ml.	0.110	0.105
400 ml.	25 ml.	0.1125	0.1025
Sample D			
1000 ml.	25 ml.	0.045	0.035
500 ml.	25 ml.	0.048	0.04
500 ml.	25 ml.	0.05	0.04
500 ml.	20 ml.	0.05	0.025
Sample E			
100 ml.	20 ml.	0.813	0.788
200 ml.	10 ml.	0.788	0.750
250 ml.	10 ml.	0.790	0.730
250 ml.	10 ml.	0.800	0.680
Sample F			
1000 ml.	20 ml.	0.05	0.0438
1000 ml.	25 ml.	0.045	0.040
500 ml.	25 ml.	0.05	0.046
Sample G			
100 ml.	25 ml.	1.00	0.98
100 ml.	20 ml.	1.062	1.00
200 ml.	10 ml.	1.00	0.938
200 ml.	10 ml.	1.00	1.0

meyer flask to obtain at least 0.001 mgm. P in 50 ml., cool, filter and dilute to 50 ml. If 50 ml. of the sample contain 0.001 mgm. P, the sample can be filtered directly into a 50 ml. Nessler tube. On the

other hand, if 50 ml. of the sample contain more than 1 p.p.m phosphorus, a smaller portion of sample should be used. Add 1 ml. of the molybdate reagent and mix well. Add two drops stannous solution and immediately compare the blue color with that formed with standard phosphate solutions treated in the same manner.

2. Total phosphorus. Concentrate enough sample in an Erlenmeyer flask in the presence of 3 ml. conc. HCl and 0.5 ml. conc. HNO_3 to obtain at least 0.01 mgm. P. Transfer to a small balloon flask, add 4 ml. 3.6 N H_2SO_4 and heat slowly over a flame until dense, white fumes of SO_3 start to form. If there is much organic matter present which begins to char, add another 0.5 ml. conc. HNO_3 and continue digestion. Sometimes there is a large amount of solids in the residue and it is necessary to add more H_2SO_4 in order to keep all of the material in contact with the oxidizing agents. Cool the sample, filter and dilute to 250 ml. Titrate an aliquot portion with 0.1 N NaOH, using phenolphthalein as an indicator, to determine the amount of acid there is left in the sample. Take another aliquot portion of the sample, neutralize with NaOH and dilute to 50 ml. Add 1 ml. of molybdate reagent, mix well and add two drops of stannous chloride solution. Make up standard phosphate solutions in the same way and make the color comparisons in matched Nessler tubes. The color develops immediately and the comparisons should be made within ten minutes because the color starts to fade.

RESULTS

Good results were obtained when using different samples of lake water. Duplicate soluble phosphate determinations were made on seven samples (labeled, A, B, C, D, E, F and G) and they were the same for each sample. The digested samples were diluted to a final volume of 250 ml. and the total phosphorus results are given in table 4.

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AN AUTOMATIC BACTERIOLOGICAL SAMPLER*

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The apparatus, herein described, is designed to take water samples for bacteriological examination at regular intervals throughout the 24 hours. It has the following advantages over manual sampling:

1. Small samples uniformly distributed throughout the day are more representative than larger samples taken at longer and irregular intervals.

2. Measured samples are taken directly into tubes containing broth, thus avoiding the use of sample bottles and pipettes, and minimizing the possibility of contamination due to handling. The average agar count of samples taken by this apparatus over a period of one month was lower than that of duplicate samples taken in bottles during the same period.

3. Since the sample is introduced immediately into broth, the chlorine residual is destroyed and death of organisms subsequent to sampling is avoided.

The apparatus, illustrated in figure I, consists essentially of a cabinet containing a row of test tubes. Over the top of these a trolley travels, drawn by a clockwork actuated cord. As it comes directly over each tube it deposits therein an accurately measured sample of water.

The trolley is shown in detail in figure II. The glass measuring cylinder has a capacity of exactly 25 ml. from the discharge tip to the overflow lip. Water to be sampled is brought to the trolley by a long rubber tube, and enters the measuring vessel by means of a glass tube carried on the armature of the magnet. Under the cylinder is another tube also carried by the armature, which catches the water from the discharge tip and conducts it to the waste trough which runs the length of the cabinet and is therefore available no matter where the trolley is. The water enters the measuring cylinder

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faster than it can run out the discharge. The cylinder therefore fills, and the excess overflows the lip and is led to the waste trough.

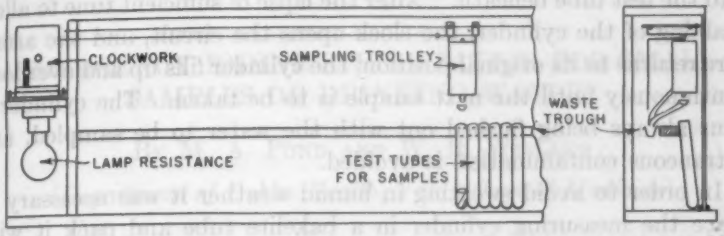

FIGURE I. GENERAL PLAN

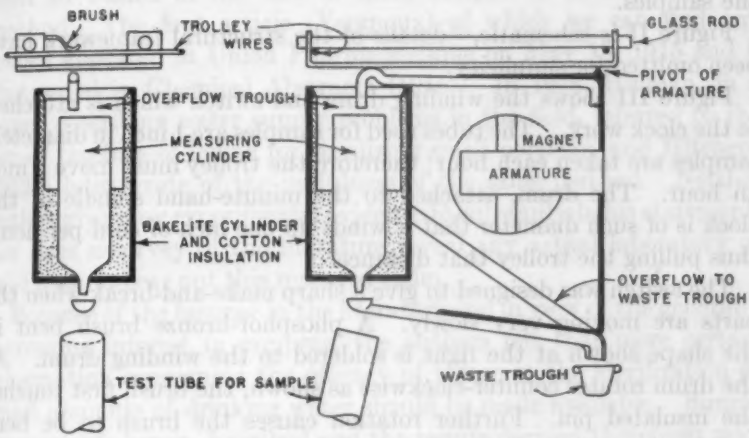

FIGURE II. SAMPLING TROLLEY

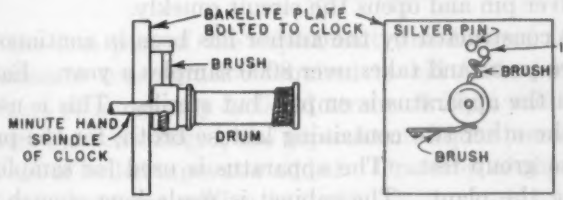

FIGURE III. WINDING DRUM AND SWITCH

When the apparatus takes a sample, the clock closes a switch, current brought to the trolley through the trolley wires, causes the magnet to draw the armature which simultaneously moves the inlet and the

discharge-catching tube aside. The full flow of water then goes to waste, and the 25 ml. which filled the measuring cylinder drops into the test tube beneath. After the lapse of sufficient time to allow draining of the cylinder, the clock opens the circuit, and the armature returns to its original position, the cylinder fills up and overflows continuously until the next sample is to be taken. The cylinder is thus always being flushed out with the water to be sampled, and extraneous contamination is avoided.

In order to avoid sweating in humid weather it was necessary to place the measuring cylinder in a bakelite tube and pack it with cotton for insulation; otherwise the condensation would contaminate the samples.

Figure II is schematic,—details of the structural framework have been omitted for simplicity.

Figure III shows the winding drum and switch which is attached to the clock work. The tubes used for samples are 1 inch in diameter; samples are taken each hour; therefore the trolley must move 1 inch an hour. The drum, attached to the minute-hand spindle of the clock is of such diameter that it winds up one inch of cord per hour, thus pulling the trolley that distance.

The switch was designed to give a sharp make-and-break when the parts are moving very slowly. A phosphor-bronze brush bent in the shape shown at the right is soldered to the winding drum. As the drum rotates counter-clockwise as shown, the brush first touches the insulated pin. Further rotation causes the brush to be bent backwards until finally it slips off the insulated pin onto the live silver pin, thus completing the circuit. Even in this position it is still considerably out of shape, and after about one minute contact it slips off the silver pin and opens the circuit quickly.

The apparatus constructed by the author has been in continuous use for nearly two years and takes over 8000 samples a year. Each third tube put in the apparatus is empty, but sterile. This is used for agar count, the other two containing lactose broth, for the presumptive coliform group test. The apparatus is used for sampling tap water leaving the plant. The cabinet is made long enough to accommodate tubes for 48 hours run, and thus permits uninterrupted sampling over week-ends.

EMERGENCY IODINE STERILIZATION FOR SMALL SAMPLES OF DRINKING WATER*

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The use of iodine as a sterilizing agent for drinking water has long been advocated in the case of small samples or as an emergency method. The first article (Vergnoux) of which we can find any record appeared in Union Pharmaceutique on May 15, 1915 and is abstracted in Chemical Abstracts (1915). In 1918, Hinman, in a paper describing water supply problems in the field, referred to the use of tincture of iodine for sterilizing small portions, and Hitchens (1922) later wrote of the usefulness of the same method. Neither author gives any experimental evidence to substantiate his statement, nor does a survey of the literature reveal any actual laboratory or field data to bear out this repeated claim.

Because of the lacunae in the literature and in view of the generally increasing interest in camping, the authors felt that more certain information concerning the efficacy of iodine in the sterilization of small amounts of drinking water should be made available. Simple experiments herein described and the results derived therefrom may interest sanitarians in general and campers in particular.

TECHNIQUE

The first part of the experiment was devoted to finding the approximate concentration required to kill *Escherichia coli*. A broth culture of a recently isolated strain of *Esch. coli* incubated for 18 hours was centrifuged, the supernatant liquor poured off, and about 10 c.c. of boiled tap water added. One drop of this suspension contained about one million bacteria.

An iodine stock solution was made by adding one drop of a 7 per cent tincture (U.S.P.) to 250 ml. of boiled tap water. The water used in making this stock solution and in all subsequent dilutions

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came from an unfiltered chlorinated supply, the residual Cl_2 before boiling averaging 0.12 p.p.m. with a maximum of 0.17 p.p.m.

To each of several test-tubes, containing 10 ml. of varying dilutions of iodine, was added one drop of the prepared coli suspension. Control plates showed that there were about 100,000 organisms per milliliter at this dilution. The concentrations of iodine were calculated on 10 ml. bases, i.e., if we desired one drop per liter of iodine, 7.5 ml. of boiled tap water plus 2.5 ml. of the stock iodine solution gave the dilution.

The test-tubes were then placed in a water-bath at 17°C. for the contact period of 15 minutes. The bactericidal action was terminated by the addition of an excess of sodium thiosulfate over that required to combine with the iodine present. Five-tenths of a milliliter (0.5 ml.) of each solution was then plated in petri dishes using extract agar pours. After incubating at 37°C. for 48 hours, the plates were counted. Control dilutions of the coli-suspension were run concomitantly.

A 15-minute time limit was used, mainly because it is doubtful that a thirsty camper would wait any longer than that before drinking. Most of the earlier investigators have specified 30-minute contact periods, but we feel that these are too long for practical purposes.

Once the approximate effective range of dilutions was found, a more intensive study was made on coli-suspensions in boiled tap water, on suspensions of *Eberthella typhosi* (Hopkins) and on a fresh typhoid strain isolated from the heart blood of a recent victim of the disease. All of this latter work was carried out in the manner described above.

Samples of lake and river water from the vicinity of New Haven were fortified with *Esch. coli* and run through the same treatment. These cultures were plated out on eosin-methylene-blue agar and coli-counts were made at 48 hours.

Finally the general procedure of *Standard Methods of Water Analysis* for presumptive tests was followed on several samples of polluted water which had been treated with iodine. The only deviation from the standard method was that we used only 1 ml. and 5 ml. samples in the lactose broth tubes. Controls were always run.

DATA

The data obtained in our investigation of the influence of different strengths of iodine indicated that, for a contact period of 15 minutes,

about 2 drops per liter of the standard 7 percent tincture was desirable. Using this procedure, with 8 water samples inoculated with *Esch. coli* and two samples inoculated with *Eb. typhosa*, and measuring results by plating on eosin methylene-blue plates, we obtained a reduction of 99.999 percent in six experiments, of 99.99 percent in three instances and of 99.9 percent in one instance. The last mentioned was a river water heavily polluted with organic matter.

In a second series of experiments, twenty-five different samples of water were similarly inoculated with *Esch. coli* and treated with 2 drops of iodine for 15 minutes as above. The reduction was then estimated by the standard lactose broth fermentation tests with confirmation of all tubes showing gas. Every one of these experiments showed a reduction of 99.999 percent.

The number of observations is sufficient as determined by the ordinary tests for size of sample. A chi-square test was made on the data obtained for concentrations of two drops of iodine per liter, and the value 33.41 with $n = 1$ is highly significant. Concentrations of 3 drops per liter did not give results which were any more significant.

It must be emphasized that the samples of water, other than those from the city supply, were all taken from potential sources for campers or tourists, i.e., clear sparkling brooks, lakes, a few streams with considerable organic matter, and a well that has repeatedly been positive for *Esch. coli*.

In order to be generally practical any method of water treatment must be relatively simple, cheap, quick and fool-proof. In addition, it must not be productive of obnoxious tastes or odors because the layman practically always will dilute the sample until no taste remains regardless of the loss of sterilizing efficiency. A number of people were asked to express their opinion as to the taste or odor of samples in which concentrations sufficient to be safe had been used. Not a single complaint was registered.

SUMMARY AND CONCLUSIONS

Iodine has long been advocated for the sterilization of small samples of drinking water, but there were no experimental data in the literature to bear out the claim. A technique for studying this problem is described and results given from which we may conclude:

Tincture of iodine 7 per cent (U.S.P.) in a concentration of two drops per liter will ordinarily be sufficient to render any potable water innocuous within fifteen minutes.

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THE COLIFORM GROUP OF BACTERIA*

By Harry E. Jordan

In the process of editing the Journal of the American Water Works Association, one becomes aware of the necessity for reasonable clarity as well as uniformity of expression when technical or semi-technical terms are being used. Previous association of the editor of this Journal with the preparation of the text of "Standard Methods for the Examination of Water and Sewage" leads to the opinion that one commonly used set of terms should be clarified in advance of the preparation of a general manual of style.

This set of terms has been used to define that group of organisms whose presence is disclosed by the standard "completed" test. This determination, which in its essential characteristics has been unchanged for twenty years, does not, as some persons still appear to believe, disclose the presence of a single species of bacteria. It is a group test. The group includes (1) aerobic or facultative anaerobic (2) Gram-negative (3) non-spore-forming organisms which (4) ferment lactose with (5) gas formation. This is the coli-aerogenes group of the eighth edition of Standard Methods. It includes the genera now called *Escherichia* as well as those called *Aerobacter*. It also includes the *Citrobacter* family. It is not specific for *Esch. coli.* nor is it specific for *Aer. aerogenes.*

References to research, where the method used is clearly the standard method, are currently erroneous if they use the term B. Coli. That term has been discarded by bacteriologists (who use precise terms) for a number of years. It has not been used in the routine text of Standard Methods since the fifth edition. It has the particular difficulty of continuing use of the term "bacillus" for a non-spore-forming organism after those directly associated with nomenclature have agreed to use the term only for spore-forming rods. The fact that the usage persists in the colloquial handling of laboratory terms is granted, but cannot be accepted as justification for continuing its editorial use. Similarly, the abbreviation E. Coli used to

* Editorial Statement

refer to the specific organism—*Escherichia coli*, cannot be approved because of the confusion relating to the term *Entameba coli* which may carelessly be similarly abbreviated, but which relates to the entirely different type of organism associated with amebic dysentery. The term *Esch. coli* must be used when specifically referring to the bacterium commonly discussed in the water works laboratory.

In order to clarify the situation; to take due note of the fact that the "completed" test is a group and not a specific organism test; and, to provide a term which will lend itself to colloquial as well as sufficiently precise use, Breed and Norton have proposed the term "coliform" (Jour. A.P.H.A., 27:560 (1937)). Thus when a person uses the words "coliform group" or "coliform organisms" in a paper covering studies of water supply quality, when the method of determining the presence of the organisms is clearly the "Standard Method" there will be no confusion nor will there be perpetuated an obsolete term, such as B. Coli. The term "coli-aerogenes" group is the one used in the current edition of Standard Methods and therefore continues to be officially correct.

Hereafter, the policy of the editor of this Journal will be to substitute the term "coliform" for the terms "B. Coli" or "colon group." Authors of papers submitted for the Journal will please take due note of this and use the term "coliform" when reference is made to the general group test. The term "coli-aerogenes" will be allowed to stand, since it is still official. It is felt, however, that the newer expression—coliform—has the associated values of reasonable precision and ease of enunciation, both of which are highly desirable characteristics where a subject of such importance to the water supply field is under discussion.

THE 1937 CONVENTION

The fifty-seventh convention of the American Water Works Association, held at Buffalo, N. Y., June 7–10, 1937, with headquarters at the Statler Hotel, found the organization definitely on the up-grade. The attendance total of 1140 overtopped any convention since paid registration started. The manufacturers' exhibit overflowed the allotted space with 82 firms occupying 115 display booths and tables.

The combination of large attendance, fine exhibits, adequate entertainment and renewed vigor of debate in the various technical sessions resulted in a fully satisfactory convention.

MONDAY—JUNE 8TH

The convention was officially opened at 9:30 a.m. by President W. W. Hurlbut. The morning session was devoted to a consideration of reports made by Water Works Practice Committees.

C. R. Knowles, chairman of the Transite Pipe committee, made reference to the fact that the report had been published in the May issue of the JOURNAL (p. 607) and pointed out that much of it was in the form of quoted excerpts from the report of the National Board of Fire Underwriters. W. D. Moore, President of the American Cast Iron Pipe Co. pointed out that the report covered but one class (150) of Transite pipe and that it made no reference to beam and bending tests. It was agreed by Malcolm Pirnie, chairman of the committee on Water Works Practice, that data making comparison of Transite and Cast Iron Pipe under beam and bending test would afford useful information. (During the convention several conferences were had by interested persons and a summary statement drawn up by Mr. Pirnie. This statement was published in the June, 1937 issue of the JOURNAL (p. 885).)

Attention was called to the fact that the report of the committee on Gate Valves had been published in the March issue of the JOURNAL (p. 408) and discussion of it was invited by Mr. Pirnie. No major questions concerning the specification were raised. (Certain issues were the subject of conferences during the convention. The list of proposed changes have been circulated among the members of the Water Works Practice Committee and the amended

document will be presented to the Board of Directors for approval at the January meeting.)

The report of the committee on Fire Hydrants was published in the April issue of the JOURNAL (p. 451). Discussion was requested by Mr. Pirnie. L. E. Goit suggested that the specification needed clarification with regard to flow tests and friction loss tolerances. There was also criticism of the section (2.3) on water hammer because of its lack of clarity. (Following this discussion, certain conferences were held and the changes suggested as a result thereof have been submitted to the committee on Water Works Practice. The amended document will be presented to the Board of Directors for approval at its January meeting.)

The Monday afternoon session (W. V. Weir, chairman of the Plant Management Division presiding) opened with a description of the Buffalo Water Works by Alan Drake.

Mr. Drake, Superintendent of the department and chairman of the local convention committee, described the developments in pumping and distribution practice in Buffalo including the recent construction of a series of elevated storage tanks and the abandonment of the old Best Street reservoir. It was pointed out that these changes had materially improved service to the water users in the city.

W. C. Mabee then presented a progress report for the committee on Laying Cast Iron Pipe. A full and active discussion followed, centering about leakage test tolerances, blocking, back filling and sterilization. The concensus of opinion appeared to be that the leakage test tolerance was too high; that blocking should be avoided whenever possible; and that careful trench preparation and effective tamping should be encouraged. The sterilization (or disinfection) practice recommended was agreed to be a major forward step, since the committee had carefully appraised current practice and presented recommendations based upon active research on the problem. The need for cleaner jute and yarn was recorded. (The committee since the Buffalo convention, has made several revisions of its first report. The final document will be referred to the Water Works Practice Committee and to the Board of Directors for approval.)

The Round Table session opened with a discussion of Leak Location and Pipe Finding under the leadership of S. F. Newkirk. E. S. Cole, H. E. Beckwith and F. B. Nelson concurred in warning that

leak detection or location and leak measurement should not be confused. T. J. Skinker agreed as to the value of flow surveys by the Pitometer method, but pointed out that the radio type leak detector often served to clear up troublesome problems. J. A. Carr and J. W. Ackerman reported instances of successful use of the radio type leak detector in locating mains and service lines thus avoiding much expensive digging and interruption to street traffic. The discussion of Fixed Period Gate Valve Operation was led by J. S. Dunwoody. It disclosed variations in practice ranging from monthly test-operations on downtown valves in Los Angeles to yearly tests of small valves in many cities. The discussion of Repairing Pipe and Joint Leaks was led by T. J. Skinker, who made reference to electric welding of pits in steel pipe as well as the use of tapered steel pins when a hole had developed. L. E. Goit spoke of both these methods with approval and added reference to the use of sleeves over badly pitted areas. Grout forced between the sleeve and the original pitted area served to protect against further corrosion of the original pipe.

TUESDAY—JUNE 9TH

The Tuesday morning session was opened with a review of "Twenty-Five Years Operation of the Los Angeles Aqueduct" by J. E. Phillips. The presentation (not written) was accompanied by a large number of lantern slides which added greatly to its value. The record of service shows that the aqueduct has been out of service less than 10 percent of the time since 1920. The majority of the length of the line appears good for at least 15 years longer. Certain areas where the walls were originally only $\frac{1}{4}$-inch thick will probably need replacement in 5 years. The steel section was designed for a flow of 430 sec. ft. with $C = 90$ predicted after 30 years use. After 25 years, at a delivery of 5–600 sec. ft., $C = 100$–105.

The balance of the morning session was required for the presentation of papers by J. K. Hoskins, Duane Minard and Abel Wolman, covering allocation of water supply sources and interstate agreements concerning them. Mr. Hoskins pointed out that much progress has been made in recent years in improving stream conditions. Cooperative programs have contributed in the Ohio River and Great Lakes areas. Pending federal legislation looking toward coordination of national and state activities will undoubtedly aid in promotion of further improvement in stream conditions.

Mr. Minard reviewed the concept of water rights and showed how eastern and western United States conditions had brought about contrasting developments. He interpreted various Supreme Court decisions as having been founded on giving preference to the highest use of water, namely, public supply. He advocated the creation of technical boards upon a permanent basis as a means of clarifying future issues. W. T. Chevalier commented to the effect that technical statesmanship was difficult to obtain and that the mere creation of federal boards did not guarantee such qualities.

Mr. Wolman, in rejoinder, commented that since the nation is dealing with boards made up of human beings working in a political environment, it must be prepared to accept certain limitations unless it is willing to adopt the military method of dealing with such problems.

Mr. Wolman's prepared address was a review of the Water Resources work done under federal direction in recent years. The papers presented by Messrs. Hoskins, Minard and Wolman together with the written discussions were published in the July issue of the JOURNAL.

The Tuesday afternoon Main Session was opened by a discussion of the Licensing of Water Works Operators in which L. V. Carpenter, E. D. Rich, C. H. Capen, Jr., and R. F. Goudey were the scheduled participants. These papers have been published in the August issue of the JOURNAL.

Dale L. Maffitt, in discussing "The Effect of Federal Legislation on Water Works Employees", pointed out that social security legislation now in force does not extend benefits to municipal employees, and that municipalities should set up pension systems to protect their personnel.

L. A. Smith gave an account of the Madison (Wis.) pension plan. D. A. Heffernan spoke of the new Massachusetts law which makes optional the creation of contributory retirement plans for municipal employees in the larger cities. Mr. Maffitt's and Mr. Smith's papers have been printed in the August issue of the JOURNAL.

The afternoon session closed with a paper by L. D. Gayton which recorded actual water-use experiences in Chicago following the growth of air conditioning. O. C. Holleran of the U. S. Department of Commerce, reviewed recent studies of air conditioning demands upon water systems made under his direction. Certain cities are reaching their limit capacity with present plant and structures.

L. A. Geupel and W. V. Weir commented upon the fact that in some cities the summer season water temperatures were so high as to require very large amounts if used for air conditioning. A. H. Miller, L. R. Howson and C. B. Burdick pointed out that if the use of public supplies for air conditioning grew upon a well regulated basis, special rate schedules must be devised. The increased use of evaporative cooling systems was forecast as a means of relieving the excess demand upon water supplies.

WEDNESDAY—JUNE 10TH

Wednesday morning's Main Session was devoted to a series of papers on the effects of the 1937 Ohio River flood upon water supplies along the stream.

J. C. Crenshaw, A. S. Hibbs, L. S. Vance, L. A. Geupel and C. M. Roos recounted conditions met at Huntington, Cincinnati, Louisville, Evansville and Cairo. L. R. Howson reviewed the catastrophe in relation to the lessons learned and protective measures necessary to protect the cities and their water supplies in the future.

The entire discussion was published in the September issue of the JOURNAL.

THURSDAY—JUNE 11TH

Thursday morning's Main Session opened with a review of the work of the Joint Boiler Feed Water Research Committee by C. H. Fellows. This inter-association project, in which G. W. Fuller and S. T. Powell of the A. W. W. A. were prime movers, has made a major contribution to the recent advances in boiler water conditioning. The work continues with certain studies in progress related to the prevention of embrittlement.

L. R. Howson and Paul Hansen respectively presented reviews of progress in "Dams, Supply Lines and Pumping Equipment" and "Water Purification." Reviews of this type have been a feature of recent annual conventions of the Association and the 1937 reviews were of high standard.

S. Logan Kerr presented a blackboard talk on Water Hammer in which several striking examples of the seriousness of this problem were given.

J. D. Sample reviewed recent advances in the production and use of small diameter cast iron pipe. The papers by Messrs. Fellows, Howson, Hansen and Sample appeared in the October issue of the

JOURNAL. Russell Barnard presented a dissertation on "Wall Thicknesses of Underground Steel Pipe." He analyzed the variations in conditions met with under varying soil conditions and strongly stressed the value of soil studies prior to the laying of long steel pipe lines. This paper was published in the June issue of the JOURNAL.

Thursday afternoon's session was a joint one of the Plant Management and Water Purification Divisions.

C. P. Hoover reviewed data concerning corrosion studies made under his direction at Columbus.

J. R. Baylis commented that the Hoover studies led one to the conclusion that the water utility should treat the supply so as to prevent cold water corrosion and leave to the consumer the installation of special hot water piping and equipment in such materials as would resist corrosion at elevated temperatures.

George D. Norcom reviewed the experiences of himself and Thos. Wiggin with 125 supplies where it had been found that treatment to a pH between 7.9 and 9.2 was required to maintain satisfactory pipe protection. Conditions varied with the degree of total mineralization of the supply as well as with normal or flood heights in the raw water source.

Further comments were made by C. R. Cox, R. S. Weston and I. M. Glace. The net result of the discussion was to indicate that there is much yet to be learned and done before the problem of excess pipe corrosion is under control.

F. N. Dawson and A. A. Kalinske reviewed cross-connection control as affected by air-conditioning uses of water supplies. Special problems due to refrigerant leakage were discussed and general cross connection faults found repeating themselves in air-conditioning installations were illustrated. The paper was published in the November issue of the JOURNAL.

There then followed a round table discussion on "Preparation of Water Works to Meet Catastrophes."

Earthquakes, conflagrations, floods and tornadoes were discussed by N. A. Eckart, H. E. Halpin, E. A. Munyan and Albert R. Davis. Their papers were published in the November issue of the JOURNAL.

This closed the general technical sessions of the convention.

FINANCE AND ACCOUNTING DIVISION

The Division held two technical sessions, a conference meeting of its accounting manual committee and a luncheon.

On Monday afternoon (June 7th) there was held a round table conference meeting of those associated with the preparation of an accounting manual. Carl F. Chatters, Executive Director of the Municipal Finance Officers' Association and C. T. Sweeney, who has been engaged in the preparation of the text, discussed the form and content of the manual with Hal F. Smith, M. F. Hoffman, Jacob Schwartz, C. J. Alfke, Louis D. Blum, John H. Murdoch as officers of the Division along with others interested in its preparation.

The first technical session on the morning of June 8th (Hal F. Smith, Division Chairman presiding) opened with a paper by Carl F. Chatters on "The Value of a Manual of Accounting for Water Works." There followed a paper by Charles T. Sweeney on "The Preparation of a Manual of Accounting for Water Works." There then followed a general discussion of the scope, contents, terminology, uses and value of such a manual. Messrs. Chatter's and Sweeney's papers have been published in the August issue of the JOURNAL. The annual luncheon of the Division followed.

The second technical session of the Division was held on Thursday morning (June 10th). H. L. Meites presented a paper on "Building and Retaining Customers' Good Will"—illustrating it with lantern slides which displayed many interesting methods developed under his direction for the purpose of improving customer attitude toward his department. Thad M. Erwin discussed "The Diversified Activities of the Los Angeles Sales Division." He outlined the variety of conditions met in the distribution of water in that city as well as the variety of contractual relations with customers because of the addition of irrigation service sales to the customary domestic-commercial-industrial classifications commonly encountered. "Internal Audit and Control" was advocated by Paul D. Williams. It was made clear that a continuously operating internal check system was at the same time a protection to the employee and the water department.

This series of papers has been published in the October issue of the JOURNAL.

JOINT BOILER FEED RESEARCH COMMITTEE

The Boiler Feedwater Research Committee, with C. H. Fellows as chairman, met on Wednesday morning (June 9th) for consideration of the chairman's report and three papers.

"Coagulation as Applied to Industrial Waters" was discussed by

A. P. Black. Co-authors of the paper were R. A. Bardwell and B. W. Graham.

A paper on the "Removal of Dissolved Mineral Solids from Water by Organic Exchange Filters" was presented by P. G. Bird. Co-authors were W. H. Kirkpatrick and Easton Melof.

The closing paper was "A Study of Contemporary Zeolites" by L. F. Collins.

All papers were actively discussed. They have been published in the October issue of the JOURNAL.

WATER PURIFICATION DIVISION

The Division held four technical sessions, the final one being a joint meeting with the Plant Management and Operation Division.

The first session was held on the afternoon of Monday, June 7th, with Carl J. Lauter, Division Chairman presiding. Reports by the chairmen of the committees on Chlorine Ammonia Treatment (F. W. Gilcreas) and Determination of Fluorides (A. P. Black) were presented. Work in progress will be fully reported upon at the next annual convention. C. W. Klassen presented results of "A Survey of the Condition of Rapid Sand Filters in Illinois." The studies indicate that there is good correlation between the over-all appearance of a filter and the comparative results of the Baylis mud-ball test. An active discussion followed with J. R. Baylis, W. M. Wallace, A. V. Graf, F. H. Jennings, N. J. Howard, H. G. Turner, W. C. Lawrence, and S. T. Powell participating. The value of adequate pre-conditioning of water for filtration was stressed as a corrective for difficulties with the sand layer.

J. R. Baylis presented the data on a highly valuable research project in his paper on "Silicates as an Aid to Coagulation." This study has provoked much interest in the water treatment field and was discussed by Prof. A. P. Black, S. T. Powell and Prof. O. M. Smith. It is evident that the Baylis studies have set into motion a new line of research in water treatment over the entire country.

Prof. J. J. Slade, in presenting a discussion of "The Dynamics of Sedimentation," continued an earlier thesis which provoked a free discussion among those mathematically inclined. Professors L. V. Carpenter and Gordon M. Fair discussed the paper, both indicating that the details of sedimentation in water treatment involved changing complex conditions difficult to evaluate upon any single line of theory.

The second session of the Division, on the afternoon of Tuesday, June 8th, opened with a symposium on Water Softening. C. P. Hoover reviewed the development of lime-soda softening; C. H. Spaulding described his recently developed" precipitators"; and S. T. Powell described recent advances in zeolite softening.

Discussion by S. B. Applebaum, A. S. Behrman and E. W. Johnson followed. The papers by Messrs. Hoover, Spaulding and Powell were published in the November JOURNAL.

The session carried on with a new venture in association program making—a Panel Discussion. The question—"How are Public Water Supplies related to the Incidence of Gastro-Enteritis" was freely discussed by C. R. Cox, F. W. Gilcreas, J. J. Hinman, A. E. Berry, Dr. N. R. Ziegler, Dr. L. W. Parr, F. E. Hale, G. D. Norcom, F. H. Waring, J. F. Norton and Abel Wolman. The entire discussion was characterized by lively interest and resulted in the Division appointing a committee to carry on and correlate the studies suggested by the discussion. This committee, entitled "Coordinating Committee on Methods of Water Treatment and Laboratory Control," consists of Geo. D. Norcom (chairman), A. E. Berry and C. R. Cox. The stenographic record of the panel discussion has been published in the August issue of the JOURNAL.

The third session of the Division on Thursday morning (June 10th) was opened with a paper on "Correlation of Bacterial Pollution with Watershed Population" by E. Sherman Chase. This was an analysis of the stream pollution studies which were made by the U. S. Public Health Service. The author expressed doubt as to the possibility of strict correlation of laboratory findings with pollution density on the watershed. The paper was discussed by S. A. Greeley and J. K. Hoskins. It is published in this issue of the JOURNAL. J. C. Vaughn presented data on "Experiences with Taste and Odor Removal at Hammond, Ind." describing the severe pollution conditions met in the raw water at this plant and recording problems involved in correlating activated carbon quality with taste and odor results obtained. This paper, with discussion by Prof. M. M. Braidech, was published in the October issue of the JOURNAL.

The method of Iron and Manganese Removal at Lincoln, Nebraska, was described by D. L. Erickson and N. T. Veatch. The use of anthrafilt in a slow sand filter was discussed by A. G. Bailey. These papers appear in this issue of the JOURNAL.

The Division's committee on "Activated Carbon Evaluation"

held a conference during the convention and definite progress was made toward a final report.

ENTERTAINMENT

The first general entertainment event was the President's reception and dance on Monday evening.

On Tuesday afternoon the ladies were guests at a fashion show and tea. That evening the Association joined in the All Division Dinner and "Water Boys Review." The combination of old friends such as Wafer, Haggeter, Inglee, Butler, Norcom and Reilly with Buffalo's own Brown, Hamilton, Grotz, McCarthy, Myers, Yates, Hendler and the Boyle brothers and with the added attraction of Los Angeles' own "Golden State Four" produced an evening which would make a rank amateur of Major Bowes. There were also two prima donnas—Mary Elva Enslow and Anna Reichl. And when Bill Orchard, at the end of the evening, told the gathering that it was his swan song, every one was saddened and no one yet wants to believe it.

Repeating a recently reinstated custom, the technical sessions were adjourned at noon on Wednesday and a special train took everyone (except the golfers) to Niagara Falls. The Cataract House was the scene of an evening dinner. The complete success of the afternoon and evening depended upon cooperation of the weather maker. The cooperation was somewhat negative, but the members and guests were not dismayed.

Thursday noon the ladies were entertained at luncheon and bridge at the Park Club. In the evening, after the presentation of awards, both ballrooms on the main floor of the Statler were used for the dance which closed the convention.

PRESIDENTS' ADDRESSES

Following the dinner Thursday evening, addresses were made by W. W. Hurlbut, retiring President and E. F. Dugger, incoming President. Mr. Hurlbut said, in part, that "the Association has taken on a new life in the manner of its growth and we are now equal in membership to the peak of December, 1930. Since January 1 of this year there have been 233 new members added to the roster of the Association. Much of this work must be attributed to the national membership committee, with the full and hard-working cooperation of the sectional membership committees. The headquarters staff

at all times has had the full cooperation of Sectional officers and the various committees.

"The Sections have shown an unusual activity during the past year. It has been my privilege to visit eleven Sectional meetings during my term of office, in all parts of the country, and in all meetings the attendance was the greatest of record in the history of the Section. I draw from this record a renewed activity and growth. The Sectional meetings, as to procedure of program, have developed the Round Table Discussion to an extremely valuable degree which in particular caters to the operators of our smaller communities where our potential membership lies. The effort put forth by the Sections in holding the short school for water works operators is extremely valuable and should be encouraged. Progress is being made in all Sections in the activity for formulating legislation toward the licensing of water works operators.

"It is my recommendation that an administrative officer attend all Sectional meetings, as it is through this contact that the Association acquaints itself with the problems of the Section, which are pertinent to the various regions of the country."

Portions of Mr. Dugger's address follow:

"If I were asked to state my hopes and aspirations for the coming year, it would be this: The greatest possible service to the greatest possible number. This means two things. First, providing facilities adequate and suitable to meet the needs and requirements of the membership of the Association, and, second, an increase in our membership.

"And then, in order to meet the needs of this enlarged membership, we should correspondingly increase our facilities and services. I do not mean to minimize the service that the Association is now rendering. I think it is perfectly splendid and I know of many instances in which it has proven invaluable to members. There is always room for improvement, however, and it is my desire that the Association be prepared and equipped to meet every demand made upon it.

"I have given some study to the membership list of our Association and it discloses a rather startling fact. That is, the apparent short tenure of office of the average waterworks official. This condition demands prompt remedial action. We should endeavor, by carefully prepared and edited articles in a national advertising campaign to educate the public and municipal authorities to the im-

portance of waterworks service, and the vital necessity of properly and adequately trained personnel, and thereby raise the social and economic status of waterworks men, and give to them a sense of security comparable to the other professions, i.e., develop a real vocational consciousness."

PRESENTATION OF AWARDS

Honorary membership in the Association, for continued and distinguished service to their communities, to the organization and to all water works men, was conferred upon Thomas Brooks, William W. Brush, Ross L. Dobbin, W. J. Orchard and W. R. Rapp.

The presentation of the honorary membership certificates was made in the following words:

Thomas Brooks—A pioneer of the Los Angeles Department of Water and Power. For fifty-four years he has been at the service of that city. He has directed the installation of more than 5,000 miles of water mains and at 75 is still in active service. A true builder of a great city—an honor to the water supply industry. We present him with Honorary Membership in the American Water Works Association.

William Whitlock Brush—For forty years in responsible service to the water users of the New York metropolitan area; when he retired in 1934, the Chief Engineer of the Department of Water Supply, Gas and Electricity; now the Editor of Water Works Engineering.

A former President of this Association, for sixteen years its Treasurer, Diven medalist in 1932, still a wheelhorse in its service. Above all courteous and kindly gentleman. We are happy to confer Honorary Membership upon him.

Ross Leonard Dobbin—One of the prime movers in the organization of the Canadian Section of this Association. In the public service of Peterborough, Ontario since 1914; Director of Water, Gas and Electricity in that community since 1929; active in all engineering circles in the Dominion; Past Chairman of the Canadian Section; Past President of the Association; Chairman of its Constitution and By-Laws Committee; Diven medalist in 1930.

A reservoir of cheer and good humor. Fully a proper addition to the Association's list of Honorary Members.

William John Orchard—For more than a score of years actively engaged in the promotion of public welfare through installations of water purification equipment; a loyal member of the Association who has always found time to give constructive thought to its advancement; one whose keen service of human interest values has made the entertainment features of our annual conventions an Association builder.

We add to our joy by giving him Honorary Membership.

William Marshall Rapp—For fifty-two years a part of the water supply organization of Atlanta; since 1892 associated with the construction department; now General Superintendent of Construction and Distribution. A member of this Association since 1899; an active member of the Southeastern Section.

One of those reliable men who contribute so quietly, yet definitely to the comfort of our cities—a worthy addition to the Association's list of Honorary Members.

The Diven Medal, awarded annually to the person whose service on behalf of the Association has been most outstanding was presented to Abel Wolman with the following citation:

Abel Wolman—From the date of his entry into the American Water Works Association in 1918, he has been actively engaged in the service of this organization and the water supply profession as a whole. His first contacts were with the water purification group. In 1922 he became editor of the journal, relinquishing the work only because of the burden of larger duties. For more than two years, he has been the chairman of the President's Water Resources Committee. In that capacity he has directed the study and analysis of the water supply and conservation problems of the entire United States. No work of more fundamental importance to the water supply field and to this Association has ever been performed by any of our members.

Abel Wolman truly deserves the citation for the "most outstanding service to the Association" and its evidence in the form of the Diven medal.

The Goodell Award, for the best paper presented and published in the JOURNAL of the Association, was given jointly to L. E. Goit and Harry Hayes, for their papers on the testing and application of protective coatings to steel pipe lines—published in the September, 1936 issue.

To the Indiana Section was awarded both the Hill and the Henshaw Cups. The first is annual awarded to the Section making the largest percentage gain in membership from one convention to the next. The second is awarded to the Section having the largest percentage of its membership present at the Section meeting. This is the first time that one Section has won both cups in the same year.

The business session closed with the announcement that the 1938 convention would be held in New Orleans.

RESUMÉ OF 1937 SECTION MEETINGS

California Section

The California Section's 1937 annual meeting was held at Sacramento on October 20–23. This was the first regular meeting of the Section in two years, because the 1936 meeting was combined with the parent Association's annual convention at Los Angeles. At that time there was held only a business meeting of the Section (on June 10, 1936) for the election of officers and other routine business.

The official hotel for the 1937 meeting was the Senator, but the meeting headquarters was the Sacramento Memorial Auditorium, where the registration, technical sessions, and manufacturers' exhibits were held. Most of the entertainment functions were held at the hotel. Total registration at the meeting was 560, of which 60 were ladies.

The first day, Wednesday the 20th, was given over to registration and inspection of exhibits, with golf for those who desired. That evening the Water Purification Dinner was held.

A break in the Thursday technical sessions was provided by a luncheon at the Sacramento Filter Plant. Buses and automobiles provided the necessary transportation each way from the Auditorium.

The annual business meeting dinner on Thursday was addressed by the Association president, Eugene F. Dugger, of Newport News, Va. Reports of officers and committees were received and the following new officers were elected for the year 1937–38: chairman, James E. Phillips of Los Angeles; vice chairman, Harry Reinhardt of San Francisco; secretary-treasurer, Carl M. Hoskinson of Sacramento; and for members at large of the Executive Committee, J. R. Barker of San Francisco, George W. Hawley of Sacramento, John S. Longwell of Oakland, Fred S. Porter of Long Beach, and Carl Wilson of Los Angeles. Nelson A. Eckart of San Francisco continues in office as the Section's A.W.W.A. director, and Robert F. Brown of Stockton remains on the Executive Committee as past chairman.

Technical sessions occupied the day on Friday until evening when a Dinner Dance and entertainment was held at the hotel.

The meeting concluded with an inspection trip Saturday morning to the Sacramento sewage pumping stations, new elevated concrete storage tanks and the filter plant.

Entertainment and sightseeing trips for the ladies were provided.

Scheduled Papers

Treatment of Ground Water Supplies in Southern California..C. P. Harnish
Use of the Metallascope in Connection with Water Supplies.Gearhard Fisher
The Surival of Typhoid in Nature.....Paul J. Beard
Sacramento Water System.....R. E. Mittelstaedt
Experience with Ground Water Replenishment Programs in Northern California.....Fred H. Tibbetts
Elevated Storage Survey for Fresno, California.....G. B. Cornell
Three Million Gallon Elevated Storage Tanks at Sacramento
Henry D. Dewell and Carl M. Hoskinson
Pipe Line Corrosion and the Langelier Index of Carbonate Saturation
F. E. DeMartini
Seasonal Temperature Variations in Relation to Water Treatment
Blair I. Burnson
Improvements in the Soap Solution Method for Determining the Hardness of Natural Waters.....K. W. Brown and P. A. Villarruz
The Central Valley Project.....Edward Hyatt
Symposium: Use of Timber in Water Works Structures
Redwood.....Edgar A. Brown
Pressure Treated Timber.....Don L. Lindsley
Wolmanized Lumber.....Charles R. Wilson
Testing of Soils Prior to Installation of Metal Pipes.....Robert Ashline
Cathodic Protection of the Mokelumne Aqueduct.....H. A. Knudson
Protection of Metals to Resist Corrosion.....A. A. M. Russell
Elimination of Carbon Dioxide in Los Angeles Aqueduct Tunnels
James E. Phillips
Licensing of Water Works Operators.....Ray F. Goudey
Round Table on General Water Works Problems

Canadian Section

The seventeenth annual meeting of the Canadian Section was held in the Windsor Hotel at Montreal, April 14–16, 1937. Total attendance was 338, including ladies.

The meeting officially opened with a luncheon on Wednesday the 14th, including the address of Section chairman F. P. Adams and

greetings from Association secretary Harry Jordan. The first technical session was held during the afternoon following, and during it the chairman announced the appointment of the members of the committees of Scrutineers, Auditors, and on Resolutions.

The business meeting of the Section opened the morning session on the 15th. The report of Section secretary-treasurer A. E. Berry was presented including an account of progress in issuance of the Section's "Waterworks Information Exchange." Section membership was reported at a new high of 207, including members from every Province and Newfoundland. The Section's financial position was verified by the report of the Committee of Auditors which followed that of the secretary-treasurer. Progress in the compiling of a "History of the Canadian Section" by R. L. Dobbin was reported and it was moved that the report be distributed to members. Report of the Scrutineers disclosed election of the following new officers for the year 1937–38:—chairman, E. V. Buchanan; trustees, A. D. Stalker and G. H. Strickland, succeeding T. Hodkinson and M. W. Rogers whose terms expire; for director representing the Canadian Section on the A.W.W.A. Board, A. E. Berry, succeeding N. J. Howard. A round table conference and a discussion of "Frost Control" concluded the morning session.

The afternoon was devoted to an inspection trip of the Montreal water treatment plant, and the annual banquet took place in the evening, including presentation of the Section's Gore Memorial Award and the past chairman's certificate.

The technical session on the morning of the 16th concluded the meeting.

About 60 ladies attended the meeting and the entertainment features included for them a tea and dinner party on the 14th and a sightseeing tour on the 16th.

Scheduled Papers

Boiler Feed Water Supplies.....James O. Meadows
Treatment Problems of Colored and Corrosive Waters
N. J. Howard and H. P. Stockwell
Functions of the Quebec Streams Commission.....P. E. Bourbonnais
Discussion.....O. Lefebvre
Frazil Ice Problems in Pumping Stations.....Robert Dorion
The Montreal Water Works System.....C. J. DesBaillets
Round Table Conference—On Water Works Problems

Water Works Systems of the Maritimes
R. D. McKay, A. A. Laflin and J. A. MacMillan
Customer Accounting and Records ..... A. B. Manson
Drought Conditions in Ontario ..... A. E. Berry

CENTRAL STATES SECTION

The annual meeting of the Central States Section was held at Dearborn, Michigan, on August 18–20, 1937. Headquarters for the meeting were in the Dearborn Inn but, as the room accommodations there were very limited, many of those attending stayed at the Book-Cadillac Hotel in Detroit. Transportation was provided between the two hotels by the Ford Motor Co. The registration was over 200.

The first session of the meeting was held on the afternoon of the 18th, Wednesday.

The Thursday morning session included an address by Association secretary Harry Jordan and a report by the Section's director on the A.W.W.A. Board, Lewis V. Carpenter. Reports were also received from the Nominating and Resolutions Committees and the following new officers were elected:—chairman, E. C. Trax of McKeesport, Pa.; vice chairman, Willard C. Lawrence of Cleveland; secretary-treasurer, Earl P. Johnson of Pittsburgh; and Section trustee, Roberts Hulbert of Detroit, succeeding W. R. LaDue. H. Lloyd Nelson, the Section's retiring secretary-treasurer, was elected to succeed L. V. Carpenter as the Section's representative on the A.W.W.A. Board of Directors. A Resolution was adopted directing the Section chairman to appoint a committee, to include himself and four others, "to consider how best to increase the usefulness of the members of the Central States Section" to the Association, and to report to the Section's next meeting. It is expected that the committee will consider, among other things, the proposals which have been made for the dividing of the Section into new Sections arranged by separate states.

Luncheon on Thursday was served at the Ford Motor Company's administration building, following which the afternoon was devoted to an inspection of the plant. The Section's annual dinner was held that evening at Dearborn Inn, followed by entertainment and dancing.

Friday morning was devoted to the second technical session, and in the afternoon both ladies and men joined in a trip to Henry Ford's

Greenfield Village and Edison Institute Museum. An alternate trip was also arranged for those desiring it to the Detroit Springwells Pumping Station.

Scheduled Papers

The Raw Water Supply of the Ford Motor Company.....Ray Dulmage
The Hydraulic Characteristics of Various Circular Settling Tanks
George E. Hubbell
Operating Kinks.....A. R. Todd
Collecting Delinquent Accounts Expedited by a Modern Consumers' Billing System.....M. F. Hoffman
Can a Municipal Water Works be Economically Operated?..W. R. LaDue
Observations on Zeolite in Water Softening and Demanganization
D. E. Davis
Filters, Their Design and Operation.....H. G. Turner

Florida Section

The eleventh annual meeting of the Florida Section was held at Camp Roosevelt, three miles south of Ocala, Florida, March 30 to April 1, 1937. This meeting immediately followed the Short Course in Water and Sewage Treatment jointly sponsored by the Section, the University of Florida and the State Board of Health.

Camp Roosevelt, originally constructed as headquarters for the Florida ship canal project, is used by the University of Florida for a school of adult education. Meals and dormitory lodgings were available to those attending the meeting at a very nominal figure. Hotels in Ocala were used by those who desired to do so.

The opening session was on the morning of Wednesday, March 31, the preceding day being available for registration and trips. This session included an address by William W. Hurlbut, of Los Angeles, president of the American Water Works Association. Technical sessions were also held in the afternoon, and during the morning and afternoon of the following day, the annual business meeting concluding the second afternoon session. A banquet and dance was held at the Hotel Marion in Ocala on Wednesday evening.

The business meeting received reports of the Auditing, Resolutions and Nominating Committees. The formation of a permanent Membership Committee was recommended. The following new officers were elected for the year 1937–38: chairman, D. S. Wallace of Ocala; vice chairman, T. M. Lowe of Gainesville; secretary-treasurer, J. R. Hoy of Jacksonville; and for trustees for 3 year terms

Keith R. Chinn of West Palm Beach and Francis R. Mills of Daytona Beach, to succeed J. E. Lyles and L. W. Culter whose terms expired.

The Short Course School held just prior to the Section meeting was of two days duration. It was under the administrative supervision of Bert C. Riley of the University of Florida, and included a number of members of the Florida Section on its faculty, also John R. Baylis of Chicago and Arthur M. Buswell of Urbana, Ill.

The total registration of the School and Section meeting included about 150 persons of which 83 men and 16 ladies were registered at the Section meeting.

Scheduled Papers

A Review of P.W.A. Water Projects in Florida.....James E. Cotton
Discussion.....G. F. Catlett
Sand Filtration.....John R. Baylis
Discussion.....A. M. Buswell and J. R. Tanner
Problems in Connection with the Los Angeles Water Supply..W. W. Hurlbut
Railroad Water Supply and the Ohio River Flood.....R. C. Bardwell
Discussion.....L. M. Fischer
Fluorine in Florida Waters—Second Progress Report.....T. W. Stearns
Discussion.....Herman Gunter, A. P. Black and E. C. Geiger
Sewage Disposal in Florida.....George W. Simons, Jr.
Discussion.....G. F. Catlett
Methods in Sewage Disposal.....M. T. Singleton
Discussion.....T. M. Lowe
Importance of Proper Operation of Sewage Disposal Plants
Arthur M. Buswell
Discussion.....H. D. Peters and M. T. Singleton
Municipal Zeolite Water Softening Plants.....Eskel Nordell
Hollywood's Municipal Automatic Zeolite Water Softening Plant
W. Austin Smith
Sarasota's Municipal Automatic Sea Water Regeneration Zeolite Water Softening Plant.....Charles E. Richheimer
Boiler Water Treatment.....J. P. Turner

Four States Section

The Four States Section of the American Water Works Association held its annual meeting April 22 and 23, 1937, at the Bellevue-Stratford Hotel, Philadelphia, Pa. This was a joint meeting with the Pennsylvania Water Works Operators Association, the officers and members of both organizations co-operating in the arrangements.

Registration commenced on the morning of Thursday the 22nd, and the first technical session was held that morning with the chair-

man of the Four States Section, Ezra B. Whitman, presiding. This was followed by an arranged buffet luncheon and the afternoon was devoted to an inspection trip to the Franklin Institute and Planetarium.

The dinner dance Thursday evening was addressed by Harry E. Jordan, secretary, American Water Works Association, and was attended by approximately 200 persons.

The Friday morning session was opened by the business meeting of the Section at which the following new officers were elected for 1937–38: chairman, H. M. Freeburn of Philadelphia; vice chairman, Carl J. Lauter of Washington; trustee to serve the unexpired one year of the term of C. J. Lauter, George R. Taylor of Scranton; trustees for two year terms, Edward S. Hopkins and Abel Wolman, both of Baltimore. Carl A. Hechmer was re-elected as secretary-treasurer. At this time also a resolution was passed condemning the appointment of local agents to represent manufacturers of water works materials, and sometimes consulting engineers, in the effort to promote business with the water department through local political contacts. The sentiment on this subject was emphasized by the discussion. This action was along the same line as that taken by the trustees of the Illinois Section and expressed in their resolution of November 21, 1936. Secretary Hechmer reported that consideration was being given to the sponsorship by the Section of the short course school which has been held at the University of Maryland. The Maryland State Department of Health and the Maryland-Delaware Water and Sewerage Association would also sponsor the school.

Following the business meeting the remainder of the morning was given over to a general discussion of a selected list of topics which had been announced in the program. This discussion was conducted by Lewis V. Carpenter.

The Friday afternoon technical session was presided over by W. S. Emigh, president of the Pennsylvania Water Works Operators Association.

(The 1936 meeting of the Four States Section was held at Baltimore, Md., on April 23, 24.)

Scheduled Papers

Operation of the Reading Filtration Plant.....Walter Strockbine
Every Filter Plant its Own Research Laboratory.....George D. Norcom
Round Table Discussion:

The Relation of Water Main Failure to Defective or Improperly Operated Fire Hydrants—Check Valves—Altitude Valves
The Relation of Air Conditioning to Water Supply
Drop in pH on Water Distribution Systems
Bacterial Pick-up on Water Distribution Systems
Sterilization of New Mains before Placing in Service
Losses in Distribution Systems—Leakage, Waste, Under Registration of Meters, Leak Surveys.....Discussion led by Lewis V. Carpenter
Problem of Back Syphonage.....E. L. Penfrase
Activated Carbon—Value of its Use—Proper Points of Application
E. A. Sigworth

Illinois Section

The Illinois Section held its 1937 annual meeting at Springfield, Illinois, on Thursday and Friday, April 29 and 30. Meeting headquarters was the Abraham Lincoln Hotel.

The first technical session immediately followed the welcome of the Mayor of Springfield, Thursday morning. Prior to adjournment that morning the chairman announced the appointment of the Auditing, Resolution and Tellers' committees.

The afternoon session was largely devoted to the presentation of papers on the subject of the recent floods, and their discussion.

The dinner Thursday evening, attended by 120 members and guests, was addressed by H. E. Jordan, secretary of the Association. Unusual entertainment was provided by the choral society composed of employees of the City Water, Light and Power Department of Springfield.

Friday morning's session comprised a comprehensive group of papers on the water works problems involved in the development of air conditioning. These papers were followed by the Section's business session in which the first item was a report by the secretary giving a resume of the five meetings which had been held by the Section's Board of Trustees during the year.

One of the activities during the past year had been the endeavor to stimulate interest in the A.W.W.A. among municipal officers by taking space in the Illinois Municipal Review, and by carrying therein from time to time interesting articles on water works subjects. This work was conducted by C. W. Klassen as editor. In addition considerable direct mail effort was put forth in the promotion of the Corporate Membership idea among city officials. This latter work included the sending of a letter and a copy of the program to each Illinois Mayor just prior to this meeting.

The treasurer's report was submitted, together with the certification of the Auditing Committee, and was accepted. The Section's representative on the Association's Board of Directors, H. E. Babbitt presented an outline of the activities of that body. Reports were also received from the Section chairman, the Scope and Policy Committee and the Resolutions Committee.

The following new Section officers were then elected for the ensuing year: for chairman, Frank C. Amsbary of Champaign; for vice chairman, Ray Crozier of Peoria. Secretary-treasurer W. D. Gerber was re-elected. No new trustee was elected to succeed Ray Crozier because of the change in the Section's By-Laws which provides for two trustees having two year terms in the future, in place of three trustees having three year terms. Under this arrangement trustees F. G. Gordon and G. B. Prindle remain in office to complete the three year terms for which they were originally elected in 1935 and 1936 respectively.

Friday afternoon's program consisted of an inspection trip to the new Springfield water works plant.

Scheduled Papers

Rapid Test for Hardness.....Max Suter
Discussion.....L. A. Nalefski
Fluorides in Illinois Water Supplies....James G. Weart and C. W. Klassen
Discussion.....J. J. Woltman
Maintenance of Filter Beds.....John R. Baylis
Discussion.....Roy C. Graves
How Louisville Water Works Met the Flood Emergencies
William H. Lovejoy
Southern Illinois and the Super Flood of 1937.....C. M. Roos
News, Views, and Lessons of Illinois Floods.....H. A. Spafford
The Trend of Air Conditioning and its Water Demand.....E. N. Bowles
The Study of Summer Cooling in Research Residence Using Water from City Water Mains.....Seichi Konzo
Air Conditioning as a Problem of Water Distribution and Disposal
Loran D. Gayton
Water Well Capacities Available for Air Conditioning....Winfred D. Gerber
Discussion of the last four papers by E. N. Bowles, Seichi Konzo, Loran D. Gayton, and Winfred D. Gerber
Moving the Springfield Water Works
S. T. Anderson and Charles H. Spaulding

INDIANA SECTION

The annual meeting of the Indiana Section was held at Indianapolis on March 25 and 26, 1937. Headquarters was the Antlers Hotel.

This meeting, as pointed out in the announcements, followed a year during which water works men of the state faced "the worst cold spell, the worst drought and the worst flood in history". Those subjects provided ample material for papers and discussions and the meeting dealt with them all as well as some others.

The first session, Thursday morning the 25th, was largely devoted to a round table discussion of lessons from the severe winter of 1936. Also included was a talk by Harry E. Jordan, secretary, A.W.W.A., on "Public Works Planning—Flood to Drought". The second session, the afternoon of the same day included purification topics for the most part.

An informal dinner that evening, to which the ladies were invited, was addressed by Mr. Jordan.

The second day, both morning and afternoon was given over almost entirely to papers and discussion of the recent flood in the Ohio and Mississippi valleys, and its attendant water works problems.

The Section's annual business meeting was held at the luncheon on Friday. New officers were elected as follows: chairman, John L. Ford of Wabash; vice chairman, Paul C. Laux of Anderson. J. A. Bruhn of Indianapolis was re-elected secretary-treasurer, and W. A. Oeffler of Jasonville was elected as assistant secretary-treasurer. H. A. Dill of Richmond was elected to represent the Section on the A.W.W.A. Board of Directors, succeeding W. C. Mabee. A resolution was adopted directing the chairman to appoint a committee to study and report at the next meeting on the advisability of licensing water works operators.

The Section's regular "Gadget Contest" was conducted during the meeting. This novel and most popular feature consists of a display of home made water works devices of all kinds by the members, with cash prizes awarded to the entries judged most useful and original by popular vote to those present. First prize went to Kenneth Thompson of Wabash, for a leak detector; second prize to H. W. Niemeyer of Indianapolis, for a device for removing stones from curb boxes.

Registration at this meeting totalled 205 men including a sufficient proportion of the Section's members to win the Franklin Henshaw Cup for 1936–37. The winning percentage, computed according to the prescribed formula was 90.3%.

Scheduled Papers

Round Table Discussion—Some Lessons from the Severe Winter of 1936
W. C. Mabee, W. H. Durbin, P. C. Gale, H. G. Hortsman, and W. J. Perrine

Construction, Maintenance and Operation of Distribution Systems
F. P. Stradling
Public Works Planning—Flood to Drought.....H. E. Jordan
Water Supply Improvements Needed in Indiana.....R. B. Wiley
Iron and CO_2 Removal.....Eskell Nordell
Municipal Water Softening.....C. P. Hoover
Chlorination.....L. H. Enslow
General Discussion of preceding four papers
Indiana Practices in Meter and Service Line Installations—Committee Report
F. A. Schaefer
Precipitation, River Stages, and Stage Forecasts, in the Ohio River Flood of 1937.....W. C. Devereaux
Sanitary Conditions in the Flood Areas.....J. K. Hoskins
Federal Plans for Flood Control in the Ohio River Basin.....H. H. Pohl
Some Lessons for the Water Plant Builders and Operators....L. R. Howson
Flood Protection in the Ohio Valley.....Charles Brossman
Operation of a Water Works System Under Flood Conditions.J. C. Crenshaw
The Damage to Water Plants—Problems in Restoring Water Service
L. S. Vance, H. G. Hortsman, and Charles Streithof

KENTUCKY-TENNESSEE AND SOUTHEASTERN SECTIONS

The annual meetings of the Kentucky-Tennessee Section and of the Southeastern Section were combined into a single joint meeting, held at Chattanooga, Tennessee, on April 5, 6 and 7, 1937. Headquarters was the Hotel Patten. This location almost exactly centered in the joint area of the two Sections. Both Sections made changes in previous arrangements in order to co-operate in this meeting. Total registration was over 300 members, guests and ladies.

The first session, Monday morning, April 5, included an address by William W. Hurlbut of Los Angeles, president of the American Water Works Association. The presentation of technical papers and their discussion continued throughout the afternoon. Monday evening's program provided a stag dinner for the men and a ladies bridge dinner, both at the Hotel Patten.

Technical sessions extended through all of the second day, the afternoon being devoted to individual, simultaneous, round table discussions on several selected topics previously announced in the program. Five such simultaneous groups had been planned, but the number was reduced to four. The evening program consisted of a banquet and dance.

Wednesday morning's session started with separate business meetings of each of the two Sections.

The Kentucky-Tennessee Section elected the following new offi-

cers: chairman, E. E. Jacobson of Lexington, Ky.; vice chairman, C. M. McCord of Memphis, Tenn.; trustees, Hall Arnold of Madisonville, Ky.; and H. C. Bristol of Alcoa, Tenn. Howard D. Schmidt was continued as secretary-treasurer. The Section offered a prize of $15 to the member who secures the greatest number of new members during the coming year. H. N. Jernigan of Lexington, Ky. was appointed chairman of a membership committee. A further study of the proposal to license water works operators was also decided upon.

The Southeastern Section elected the following new officers: chairman, D. Rhett Pringle of Thomasville, Ga.; vice chairman, C. P. Townsend of Abbeville, S. C.; trustees for two year terms, F. G. Crow of Florence, Ala., and M. G. Stewart of Natchez, Miss.; trustee for one year term to fill the unexpired term of C. P. Townsend J. L. Hawkins of Greenville, S. C.; representative of the Section on the A.W.W.A. Board of Directors, J. K. Marquis of Spartanburg, S. C. Secretary-treasurer W. H. Weir of Atlanta was re-elected. T. E. P. Woodward of Macon, Ga. remains in office as Section trustee.

The ladies were made very welcome at this meeting. On Monday afternoon they were taken to Lookout Mountain and during the evening they were entertained at the bridge and dinner previously referred to. On Tuesday an inspection trip to the Davenport Hosiery Mill was arranged.

The meeting was officially concluded on Wednesday at noon, except for a golf tournament at the Chattanooga Country Club which was played that afternoon.

(The 1936 meeting of the Southeastern Section was held at Savannah, Ga., on April 7–9.)

Scheduled Papers

Public Safety as Related to Water Works Operation in the South
T. W. Coleman

Some Problems Confronting Water Works Officials in Control of Water Borne Diseases.....F. W. Kittrell

Chemical Character of Natural Waters.....W. L. Lamar

Sanitary Protection of Public Water Supplies.....A. E. Griffin

The Birmingham Industrial Water Supply.....A. Clinton Decker

Comparisons of Filter Bed Materials....H. G. Turner and H. W. Schumpert

Removal and Sterilization of Organic Detritus by Absorbent Clays
E. M. Slocum

Informal Round Table Discussion

Pumps—Their Operation and Maintenance.....J. J. Dargan

Filter Plant Operation.....Paul Weir

Meters and Services.....R. C. Warkman
Pipe—Coating, Lining and Joint Materials.....Thomas F. Wolfe
Business Management.....D. Rhett Pringle
Licensing of Water Works Operators.....W. W. Brush
Emergency Operation of Water Supplies in the Flood Districts
William H. Lovejoy

Minnesota Section

The Minnesota Section held its 1937 meeting at the St. Paul Hotel, St. Paul, Minnesota, on October 7, 8 and 9. The registration was 124, not including the ladies.

The meeting was organized and registration started on the morning of the seventh, Thursday, and the first technical session was held that afternoon. Technical sessions also were held both morning and afternoon of the second day.

On Friday a luncheon meeting was held at which the Section business was transacted. The gathering was addressed by H. E. Jordan, A.W.W.A. secretary, and by L. N. Thompson, the Section's representative on the A.W.W.A. Board of Directors. Committee reports were received. A. F. Mellen of Minneapolis, reviewed the work of the water works school, and J. C. Flanagan of St. Paul discussed the progress of the Association's work in the preparation of a water works accounting manual.

New officers were elected for the year 1937–38 as follows: chairman, Felix Seligman of Duluth; vice chairman, J. A. Jensen of Minneapolis; trustee for a three year term succeeding Eugene Schwarz, C. L. Elliott of Austin. Secretary-treasurer R. M. Finch was re-elected.

The banquet, including entertainment and dancing was held Friday evening.

The program on Saturday comprised an inspection trip to the Twin City Filtration Plant.

(The 1936 meeting of the Minnesota Section was held at Minneapolis on Nov. 6–7.)

Scheduled Papers

Softening of Highly Colored Water at Minneapolis
Edgar W. Johnson and Frank Raab
Round Table Discussion—Pumping and Power Problems in Smaller Communities.....Discussion led by C. L. Elliott, Ben Hunt and J. E. Young
Improved Method of Sub-surface Operations for Filtering and Washing
Ira H. Jewell

The Corrosion Problem in General.....C. A. Mann
Chemical Treatment for Corrosion at Ely.....J. E. Thompson
Discussion of Social Security Acts and Wagner Act.....Rudolph Lee
Round Table Discussion—Chlorination Where Used As the Only Treatment
Discussion led by Lewis I. Birdsall, O. E. Brownell, and Ole Forsberg
Iron Removal at Blue Earth.....Axel Moline

Missouri Valley Section

The Missouri Valley Section, comprising the states of Iowa, Kansas, Missouri, South Dakota and eastern Nebraska, held its annual meeting at Omaha, Nebraska, on November 4, 5 and 6, 1937. Headquarters was the Hotel Fontenelle. Attendance has been reported as 225 persons.

The meeting opened on the morning of the 4th, Thursday, with the first technical session, but included in this first session were also the welcoming addresses and a talk by Harry Jordan, secretary of the American Water Works Association. Committee appointments were made and the Nominating Committee made its report. Technical papers made up the afternoon program, and that evening a stag smoker was held in the hotel.

On Friday morning, after a short technical session, the meeting adjourned for an inspection trip to the Florence Plant of the Omaha Water Works. Lunch was served at the filter plant, after which the party returned to the hotel and technical work was resumed.

The afternoon session was concluded with a business meeting of the Section at which officers' and committees' reports were heard. The following new officers were elected: chairman, D. L. Maffitt of Des Moines, Iowa; vice chairman, B. L. Ulrich of Manhattan, Kansas; Earle L. Waterman, the Section's secretary-treasurer was also elected as the Section's representative on the A.W.W.A. Board of Directors. Mr. Waterman will take office at the New Orleans convention next spring. New Section directors were elected as follows: for Iowa, Charles Alexander of Ames; for Kansas, F. A. Rathert of Junction City; for Missouri, Clarence Hoen of Carthage; for Nebraska, Lee M. Nelson, of Hastings; for South Dakota, E. R. Mathews of Aberdeen.

The Section's annual dinner dance took place Friday evening.

On Saturday, following a meeting of the Executive Committee of the Section, the party left the hotel for an inspection of the new manganese removal plant of the Lincoln City Water Works, located at Ashland, Nebraska. Lunch was served at the plant.

Many of the delegates attended the football game at Omaha that afternoon.

Ample provision was made for the entertainment of the ladies during the meeting. On Thursday afternoon a shopping tour had been arranged, followed by dinner and bridge or theatre party. The ladies also accompanied the groups on the inspection trips on Friday and Saturday.

Scheduled Papers

Operation Problems at the Omaha Water Treatment Plant....F. B. Lasell
Water Softening and Iron Removal.....J. C. Tracy
Rates, Valuation, and Water Ordinances.....E. B. Black
Control of Water Piping from Main to Consumer
F. M. Dawson and A. A. Kalinske
Chemical Methods in Slime and Algae Control.....H. K. Nason
Super deLavaud Pipe Film
The Use of Colloidal Clays in Water Purification.....H. L. Olin
The Geology of the Ft. Dodge, Iowa, Water Supply.....A. C. Tester
The Fort Dodge Water System.....John W. Pray
Iowa Precipitation Trends and Their Significance
J. W. Howe and Edward Soucek
Practical Application of the Hardy Cross Method to the Analysis of Water Distribution Systems.....C. S. Timanus

Montana Section

The twelfth annual meeting of the Montana Section was held at Lewistown, April 21 and 22, 1937, at the Burke Hotel. The meeting immediately followed the School for Water Works Operators and Superintendents, also held in Lewistown on the 19th and 20th. This Section, while the smallest in numerical membership, is by no means the least energetic one. Few other Sections can get 60% of their members together at a meeting, yet this Section was disappointed with that figure. The total registration was 67.

The water works school preceding the meeting was held in the local High School. The course dealt very extensively with ground water subjects. 58 persons registered, including a number of professional well drillers, and many of them remained for the Section meeting.

The meeting program commenced on the morning of Wednesday the 21st, at which time the gathering was addressed by William W. Hurlbut, of Los Angeles, president of the American Water Works Association. Reports of the Section secretary-treasurer, H. B.

Foote, and of its representative on the Association Board, J. M. Schmit, were received, also reports of standing committees.

Motion pictures were shown during the luncheon that noon.

Wednesday afternoon and Thursday morning were devoted to the presentation and discussion of technical papers. A novel subject on the program was an address entitled "The One Man Town", by John Gough, City Clerk, Water Superintendent, Chief of Police, etc., etc., East Helena, Montana.

The dinner dance was held on Wednesday evening at the Fergus Hotel.

Thursday afternoon's program included a "Question Box" discussion consisting of the opening and discussion of questions which had been deposited by the delegates previously during the meeting. This was followed by a business session, including the election of the following officers: chairman, Roy N. Arnold of Whitefish; vice chairman, George E. Atkinson of Havre; trustees, Wade Plummer of Butte and A. J. Roberts of Helena. Section secretary-treasurer H. B. Foote was continued in office.

The Section adopted a resolution directing the chairman to appoint a committee "to investigate the matter of regulating the appointment of water works operators and to prepare legislation to be submitted to the State Legislature at its next session, to the end that more stabilized tenure and increased efficiency may be secured". This subject was extensively discussed and the committee was appointed, headed by Kurt Wiel of Miles City.

Bozeman was selected as the location for the 1938 meeting.

Entertainment for the ladies included a bridge luncheon at the Fergus Hotel on Wednesday.

Scheduled Papers

Symposium on Reservoirs.....Discussion led by George Atkinson
The Relationship of the Fire and Water Department.....Art. J. Baker
The One Man Town.....John Gough
Water and Sewage Systems Constructed by the Public Works Administration in Montana.....V. H. Walsh
The Water Supply System of Lewistown
Unfair Trade Practices as They Relate to the Water Works Field
John W. Hall
Construction Features of the Fort Peck Project.....C. H. Chorpening
Montana's Works Progress Administration.....E. Sandquist
The Ethics of Contracts Guaranteeing Well Capacity.....George Arnold
Problems in Connection with the Los Angeles Water Supply...W. W. Hurlbut

Plumbing Cross Connections.....C. W. Brinck
The Uses of Raylig as a Road Surface Material.....E. B. Westlund

New England Section

The annual business meeting of the New England Section was held on March 18, 1937, immediately following the meeting of the New England Water Works Association at Boston on that same day. The following new officers were elected for 1937–38: chairman, Warren J. Scott of Hartford, Conn.; vice chairman, Sidney S. Anthony of Augusta, Maine. Secretary-treasurer Samuel M. Ellsworth, and trustees Harold W. Griswold and Frank A. Marston were re-elected. The Section's representative on the A.W.W.A. Board is Robert Spurr Weston, whose three year term did not expire.

New Jersey Section

The New Jersey Section has held three meetings during 1937. The first of these was on March 3 at New Brunswick and was called on short notice and particularly for the consideration of state legislation which had been introduced for the reorganization of the water supply control agencies in the state, and also for the revision of the operator's licensing laws. 93 men attended.

This meeting convened in the Physics Building auditorium at Rutgers University at 2 p.m. The program was informally arranged. Among the speakers were George S. Burgess, chairman of the State Water Policy Commission, who explained and discussed the proposed water control Acts. A general discussion of this topic followed. Charles H. Capen then outlined the development of the licensing of water works and sewage plant operators in New Jersey and discussed the changes which were proposed in the present laws governing it. Licensing in this state is administered by the State Health Department under one of the first state laws on this subject—put into effect in 1918. The session then discussed the proposed Acts for the regulation of well drilling in New Jersey.

Following the afternoon session the meeting adjourned to the Woodrow Wilson Hotel where dinner was served. The group were here addressed by Harry E. Jordan, secretary of the American Water Works Association and by Chrystal Brown of the North Jersey District Water Supply Commission. Wellington Donaldson of the New York City Department of Sanitation then gave an illustrated talk on his recent experiences in the Ohio River Flood area.

The second New Jersey meeting in 1937 was also a one day meeting, held in the Essex House, at Newark, on May 21. 97 men attended.

The program commenced in the morning with a series of technical papers on the water supply of Newark. The luncheon following was organized so as to develop enthusiasm among those present for attendance at the annual convention of the Association which was to follow in two weeks. The New Jersey attendance at the Buffalo convention testifies to the success of this effort. The luncheon was addressed by Chrystal Brown of Wanaque, and by the Section's Director, William J. Orchard.

The afternoon's technical session, having to do principally with water supplies for fire protection, concluded the meeting.

Scheduled Papers

History of the Newark Water System.....William G. Bank
Newark's Water Supply Problem of the Immediate Future..James E. Garratt
Steel Transmission Lines in Newark's Water System....Alfred B. Anderson
Newark Distribution System Operating Problems.....A. J. Simpson
Water Supply for Fire Protection in Small Municipalities
Robert C. Dennett
The Relation of Water Works to Automatic Fire Protection
Winthrop M. Jones
Fire and Explosion Hazards in Sewage Treatment Plants..Robert M. Cadman

The fall meeting of the New Jersey Section was held at Atlantic City on Friday and Saturday, October 15–16, 1937. Headquarters was the Claridge Hotel. Registration totalled 195, including 66 Section members, 96 men guests and 33 ladies.

The program on Friday morning included a symposium on deep well pumping units, and the installation of new Section officers previously elected. The new officers were as follows: chairman, William R. Conard of Burlington; vice chairman, George F. Wieghardt of Weehawken; secretary-treasurer, Harry N. Lendall of New Brunswick; trustee for two years, Charles H. Capen of West Orange. The term as trustee of J. A. Carr continues until 1938.

The first half of the afternoon program concentrated on consideration of major water supply developments in New Jersey. A paper on this subject by C. H. Capen had been preprinted in this Journal (29:1308 (1937)) and much discussion developed. This was followed by a superintendents' round table on several announced topics.

At the dinner Friday evening the principal speaker was Eugene

F. Dugger of Newport News, president of the American Water Works Association. A feature of his talk was the presentation of an Honorary membership certificate to the Section's Director, William J. Orchard. An American Water Works Association badge was presented to the retiring Section chairman, S. F. Newkirk, Jr. The Association's secretary, Mr. Jordan, had been expected, but was unable to be present.

The Saturday morning session included a number of technical papers and also a business meeting of the Section at which three resolutions were adopted calling for action on the development of further major water supplies in northern New Jersey. These resolutions condemned previous efforts along this line and directed the Section's officers and committee on Water Supplies to proceed with whatever course appeared advisable. The preparation of new legislation was discussed.

The meeting concluded with a golf tournament during the afternoon.

Scheduled Papers

Operation and Maintenance of Deep Well Pumping Units....J. D. Campbell
Recent Improvements in Deep Well Pumping Equipment
H. W. Stoddart, A. W. Ross and Henry Folz
Major Water Supply Developments in New Jersey—A Statement of the Problem.....Charles H. Capen, Jr.
Discussion
Howard T. Critchlow, Welcome W. Bender, Harry E. Newell and J. E. Brooks
Superintendents' Round Table
Water Main Disinfection
Discussion led by E. Vernon Smith and Roswell M. Roper
Delinquent Bill Collections.....Discussion led by Samuel Gray
Meters—Questions on Their Design, Installation and Maintenance
Discussion led by James G. Carns
Electrolytic Corrosion.....Discussion led by M. Warren Cowles
Copper Pipe—Installation, Maintenance, Type of Fittings
Discussion led by Kenneth Van Brunt
State Supervision of Watersheds.....H. P. Croft and D. M. Ditmars
Preliminary Studies on Bathing Pollution of Potable Supplies
Willard C. Mallalieu
Chlorine and Ammonia Treatment of Wanaque Supply.....L. T. Purcell
Discussion.....A. E. Griffin and John L. Radcliffe

New York Section

The New York Section in recent years has generally held three meetings each year—a spring meeting, a fall meeting, and a one

day winter meeting. The 1937 spring meeting was not held, this activity being combined with the annual convention of the American Water Works Association, held at Buffalo, N. Y., June 7–11, 1937.

The Section's winter meetings have been customarily held in New York City during the week between Christmas and New Year's Day. The last one was held on Dec. 29, 1936, at the Hotel New Yorker in New York City. The program comprised a luncheon followed by an afternoon program of technical papers and discussion. The luncheon was preceded by a meeting of the Section's Board of Trustees. Total registration was 130 men. Ladies do not ordinarily attend this meeting.

Attendance of those in the New York City metropolitan area naturally predominates at these winter meetings, but there are generally included a considerable number from distant parts of the state, and also representation from the adjoining states of New Jersey and Connecticut.

The Section's new officers for 1937–38 were selected at this winter meeting. This has generally been done at the spring meeting, but was done at this time because of the omission of the spring meeting in 1937. The terms of the new officers were fixed as commencing on March 1, 1937. The new officers selected were: chairman, Alan D. Drake of Buffalo; vice chairman, E. L. H. Meyer of Glens Falls. Charles R. Cox of Albany was elected to the Board of Trustees, and R. K. Blanchard was continued as secretary-treasurer.

Scheduled Papers

Use of Activated Carbon in Water.....E. A. Sigworth
The Cost of Water and Who Pays for It.....Charles H. Capen, Jr.
Round Table Discussion

The New York Section's annual fall meeting was held in Schenectady, N. Y., on Thursday and Friday, Sept. 30–Oct. 1, 1937, at the Van Curler Hotel. Registration totalled 193 men.

Registration commenced on Thursday morning and the program started with luncheon in the hotel. Following the lunch chairs were pushed back and the gathering was addressed by Eugene F. Dugger of Newport News, Virginia, and president of the American Water Works Association. Harry Jordan, secretary of the Association then delivered a talk. The remainder of the afternoon was devoted to technical papers and their discussion. The banquet was held that evening, followed by a short program of entertainment.

A feature of the meeting was the formal announcement and explanation of the water works operators licensing regulations which went into effect in New York State on October first, 1937 under the State Health Department, and by authority of recent state legislation.

A technical session was held Friday morning. The second half of this period was assigned to a superintendents' round table and to the discussion of "question box" subjects. These questions had been previously deposited in a question box by those at the meeting and were opened for discussion during the session.

Friday afternoon was left open for golf and for an arranged visit to the plant of the General Electric Co.

Scheduled Papers

Special Studies of Distribution System Betterment at Schenectady
John H. Burwell

Aims and Activities of the National Fire Protection Association
J. Walter Ackerman

Evolution of Water Purification from an Art to a Science....James M. Caird

The Design and Operation of Recently Constructed Filter Plants at Cayuga and Palmyra.....C. E. Elmendorf

The Water Supplies of Long Island.....George Norcom

Round Table Discussion

Maintenance of Distribution Systems.....Alan D. Drake

Transite Pipe.....M. W. Plum

Corrosion Control.....George Norcom

Iron and Manganese Removal at Albany by Use of Copperas and Lime
George Wilcomb

The Status of WPA and PWA.....Earl Devendorf

The Water Resources Committee of the State Planning Board
C. A. Holmquist

Training and Licensing of Operators of Water Purification Plants
A. F. Dappert

The Value of Laboratory Control of Small Filter Plants....Edward Dyer

North Carolina Section

The 1937 annual meeting of the North Carolina Section was held at Wilmington, N. C., at the Hotel Cape Fear, on August 26, 27 and 28. As has been the custom of this Section the meeting was held jointly with the state Sewage Works Association, the papers on water and sewerage being interspersed. Attendance was approximately 150, the small number being attributed to the early date of the meeting.

Technical work commenced on Thursday, the 26th, immediately following the welcoming addresses. It was continued after the lunch hour until the mid-afternoon when an inspection trip was taken to the Wilmington water treatment plant. That evening there was a dance at Lumina, Wrightsville Beach.

The presentation and discussion of technical papers continued throughout Friday, until the latter part of the afternoon when the Section's business meeting was held. New officers elected were: chairman, James W. Kellogg of Raleigh; vice chairman, R. Allen Thomas of Winston Salem. Secretary-treasurer A. R. Hollett was continued in office. The business session also included active discussion of the progress of the operator licensing legislation which had failed in the state legislature that year.

The banquet Friday evening was addressed by E. F. Dugger, of Newport News, Va. and president of the A.W.W.A. Also included was the award of the Section's Maffitt Membership Cup. This cup, donated by McKean Maffitt, is awarded annually to the member of the Section who is responsible for securing the greatest number of new members during the year. The recipient this year was George S. Moore of Albemarle, N. C. The entertainment that evening included amateur sleight of hand of a high order.

Saturday morning's program included the "Water and Sewage Works Clinic", or trouble hour as it is elsewhere termed. There was extensive discussion of corrosion and galvanic action.

It was decided to hold the 1938 meeting of the Section at Greensboro.

Scheduled Papers

The Water Treatment Facilities of Wilmington.....McKean Maffitt
Bromine Extraction from Sea Water
Increased Efficiency of Solids Removal in Sewage Treatment
Carl E. Trexler
Public Health Engineering Work on the 1937 Ohio River Flood..D. S. Abell
Treatment of Sulphur Dye Waste by the Activated Sludge Process
H. J. Miles, Ralph Porges, and J. C. Geyer
Factors Governing the Aerobic Decomposition of Sewage Sludge Deposits
H. G. Baity
Refuse Disposal and Public Health.....Harrison P. Eddy, Jr.
Sewage and Garbage Disposal—Related Municipal Functions..Morris Cohn
Symposium—Special Water Treatment Problems
The Treatment of Natural Waters for Prevention and Control of Corrosion
C. W. Borgmann

The Softening and Deferrization of Well Water Supplies....N. D. Doane
The Treatment of Boiler-Feed Waters.....P. W. Frisk
Water and Sewage Works Clinic
Water Works Section.....Conducted by A. O. True
Sewage Works Section.....Conducted by Morris Cohn

Pacific Northwest Section

The Pacific Northwest Section of the American Water Works Association, including the states of Oregon, Washington and northern Idaho, held its 1937 annual meeting outside of its own territory, at Victoria, B. C., Canada. The meeting took place on Thursday, Friday and Saturday, May 20–22. The Empress Hotel was the meeting headquarters. Attendance was aproximately 150.

Technical discussions started with a Round Table on Thursday afternoon, following a Golf Tournament that morning. A business session of the Section was held that evening, after which resumption of the Round Table was scheduled. New officers elected were: chairman, M. H. McGuire of McMinnville, Ore.; vice chairman, N. A. Gilman of Yakima, Wash.; trustee R. E. Koon of Portland, Ore. Secretary-treasurer Fred Merryfield and trustee H. D. Fowler remained in office. Extensive discussion of the proposed licensing of water works operators took place.

Friday was devoted to technical sessions, both morning and afternoon. The dinner and entertainment took place that evening.

Saturday was spent in sight seeing trips.

Scheduled Papers

Round Table Discussion
Promoting a Greater Use of Water
Civil Service and Pension for Employees
Freeze-up Problems during the Past Winter
Recent Developments in Coagulation Mechanisms and Chemicals
Maintaining Service While Replacing Mains
Licensing Water Works Operators
Underground Water Resources of Washington.....N. C. Jannsen
Discussion.....R. G. Tyler
The Water Supply System of Victoria.....G. M. Irwin
Discussion.....Ernest MacDonald
The Salem Water System.....C. Van Patten
Discussion.....R. E. Koon
The Importance of Water Main Disinfection.....Roy M. Harris
Discussion.....C. M. Everts, Jr.
Waterworks Problems in Smaller Municipalities.....C. V. Signor
Discussion.....R. F. McLean

The Unusual in Water Supply.....E. A. Cleveland
Discussion.....W. H. Powell

Rocky Mountain Section

The eleventh annual meeting of the Rocky Mountain Section was held at the La Fonda Hotel in Sante Fe, New Mexico, on Sept. 20–23, 1937. Held in conjunction with it was also the first meeting of the Rocky Mountain Sewage Works Association which was organized at the meeting of the previous year. Registered were 48 members, 41 men guests and 26 ladies, totalling 115.

The technical sessions at this Section's meetings make up what is termed the Rocky Mountain Water Works College. Under this plan "attendance at each session of the Water Works College with evidence of genuine interest in the lectures" entitles the person to a certificate from the University of New Mexico. These certificates were presented at the banquet. At past meetings in Colorado the certificates were presented by the University of Colorado. This was the seventh such Water Works College.

The regular program commenced on Monday the 20th at which time addresses of welcome were delivered and responded to by the Section chairman. Reports were also received on the 1937 A.W.W.A. convention by D. D. Gross, and on Association affairs by P. S. Fox, the chairman. Technical sessions commenced after lunch and continued through the afternoon and the morning of the next day.

At the luncheon Tuesday noon the meeting was addressed by William W. Hurlbut, of Los Angeles, past president representing the Association at the meeting. The Section's business meeting then followed at which the following new officers were elected: chairman, O. J. Ripple of Denver; trustees to serve three years, L. O. Williams of Cheyenne, Wyo.; and K. F. Darling of Rock Springs, Wyo. Secretary-treasurer B. V. Howe was re-elected. Reports were received from the Secretary-treasurer and the Section's director, L. C. Osborn. The secretary's report included a proposal for licensing of operators which was actively discussed.

Technical sessions resumed on Wednesday consisting of joint sessions of the Section with the Sewage Works Association. They continued through the day and the annual banquet took place that evening. Thursday the 23rd was devoted to technical sessions and a "business luncheon" of the Sewage Works Association.

Several interesting events were scheduled outside of this regular meeting program. Before the meeting, on Friday the 17th, an inspection trip was arranged to the sewage treatment plants at Brighton, Fort Lupton, Greeley, Loveland, Berthoud and Boulder, Colo., and to the water filter plant at Longmont, Colo. On Saturday a trip was arranged to Denver's sewage treatment plant and to the new Moffat filter plant. On Sunday the "caravan" proceeded to Santa Fe, N. M. where the group met that evening at a complimentary dinner given to all new members of the Rocky Mountain Section and where each new member was formally introduced. After the meeting an inspection trip was arranged to Conchas Dam on the Canadian River near Tucumcari, N. M.

Scheduled Papers

Coal vs. Sand for Filter Media.....O. J. Ripple
Discussion.....Charles Riddell
Control of Micro-Organisms in Reservoirs.....George Turre
Discussion.....John Hay
Fluorine in Water Supplies.....John D. Clark
Discussion.....J. C. King
Hydraulics of Distribution Systems.....D. B. Jett
Water Waste Survey.....J. P. Soderstrum
Frozen Services.....A. S. Sharp
Discussion.....Howard Sharp
Water Rates.....Jackson Brown
Grand Lake-Big Thompson Diversion Project.....Porter J. Preston
Discussion.....L. C. Osborn
Conchas Dam Project.....Hans Kramer
Increasing Ground Water by Conservation Methods.....Clifford Ward
Federal Stream Pollution Legislation
Discussion.....Paul S. Fox, L. O. Williams and B. V. Howe
Trailer Camp Grounds Design.....E. M. Howell
Discussion.....L. O. Williams
Interpretation of Sanitary Vital Statistics.....Frank S. Morrison
Operating Records of Water and Sewage Plants.....L. C. Billings
Discussion.....Dana E. Kepner
Community Sanitation Project
D. M. Williams, O. B. Dietterich, and J. M. Schirk
Sewage Treatment Progress in the Rocky Mountain Region
B. V. Howe, Paul S. Fox, and L. O. Williams
Treatment of Beet Sugar Factory Wastes.....E. F. Eldridge
Discussion.....R. W. Gelder
High Rate Trickling Filters.....J. A. Montgomery
Discussion.....Earl M. Kelly
Principles of Sewage Treatment.....J. H. Dorroh

Application of Sewage Treatment Processes
Chemical Treatment.....Dana E. Kepner and R. W. Gelder
Activated Sludge Treatment.....F. M. Veatch
Trickling Filters.....L. C. Osborn
Development and Design of Minneapolis-St. Paul Sewage Disposal Plant
George Schroepfer

SOUTHWEST SECTION

The annual meeting of the Southwest Section was held at Galveston, Texas, Oct. 18–21, 1937, at the Galvez Hotel. Attendance totalled approximately 180 men and 40 ladies. This was the 26th annual meeting of the southwest group, but the third meeting since it became a Section of the A.W.W.A.

Registration commenced and the opening addresses were delivered on Monday morning, the 18th, and a luncheon was held that noon. The afternoon session was opened by an address by Association president Eugene F. Dugger of Newport News, Va. following which the presentation of technical papers began. That evening a dance was held in the hotel.

Tuesday morning was also devoted to technical papers. During the afternoon an inspection boat trip was taken which proved very popular. A sea food dinner was served that evening.

Technical papers and their discussion were resumed on Wednesday and during the afternoon meeting a business session was held at which Oklahoma City was selected as the location for the 1938 meeting. The following new officers were elected: chairman, T. L. Amiss of Shreveport, La.; vice chairman, Albert Davis of Austin, Tex.; trustees, for Arkansas, L. A. Jackson of Little Rock; for Louisiana, Alfred F. Theard of new Orleans; for Oklahoma, M. T. Vanlandingham of Muskogee; for Texas, R. W. Harding of South San Antonio. Secretary-treasurer Lewis Quigley was re-elected.

A dinner dance was held Wednesday evening.

Thursday morning was devoted to the remaining business and additional technical work, after which the meeting was adjourned.

Scheduled Papers

The Organization and Preparation of Water Works to Meet Major Catastrophes:
Floods.....W. B. Masterson
Fires.....H. Oran Smith
Tornadoes and Tropical Hurricanes, and Sanitation after Major Catastrophes.....V. M. Ehlers

Water Treatment to Control Corrosion as Affects Railroads.J. H. Davidson
Discussion.....H. L. McMullen
Geology of Ground Water Supply Resources.....Walter N. White
Discussion.....E. H. Sellards
Conservation of Ground Water.....A. H. Dunlap
Fluorine in Drinking Water.....Edward Taylor
Financing Water Main Extensions.....L. A. Jackson
Building and Retaining Customer's Good Will.....Lloyd Rebsamen
Accounting for Water.....Marvin C. Turner
The Waterworks Commission Form of Government.....Thos. L. Amiss
Maintenance and Repair Costs of a Water Works System..M. B. Cunningham
Developments of Water Registering Devices.....F. W. E. Weisse
Licensing of Operators.....Edward R. Stapley
Discussion.....H. J. Darcy
Office Records and Machine Billing.....H. J. Baker
Water Usage in Air Conditioning.....Homer A. Hunter
Control of Water Sheds.....A. M. Brenneke
Design and Construction of Sewage Treatment Plants.....C. G. Levander
Maintenance and Operation of Sewage Treatment Plants.....W. S. Stanley
Sewage Treatment in Controlling River Pollution.....John H. O'Neill
Discussion.....Dave C. Smallhorst and Conde R. Hoskins
Cooperation of Waterworks with Other City Departments....Max Starcke

VIRGINIA SECTION

The 1937 annual meeting of the Virginia Section was held at Richmond, Va., on Nov. 4–5. Headquarters was the Jefferson Hotel. Registration included 27 Section members, 160 men guests and 23 ladies, totalling 210.

The morning of the first day, Thursday, was assigned to registration and the golf tournament at Hermitage Country Club. After lunch the formal meeting convened and was addressed by Eugene F. Dugger of Newport News, Va. and president of the American Water Works Association. Mr. Dugger was particularly honored by this meeting of his own home Section. Following Mr. Dugger's talk the technical work was commenced.

The Section's annual banquet and dance were held that evening, in the hotel, with an estimated attendance of nearly 300.

Friday morning was devoted to the presentation of a series of technical papers discussing the new developments in various phases of the water works business, followed by a general discussion. The new officers of the Section for 1937–38 were announced as follows: chairman, Hugh B. Rice of Lexington; vice chairman, H. A. Johnson of Danville; trustee, C. L. Crockett of Roanoke. Secretary H. W. Snidow and treasurer E. C. Meredith were both re-elected.

Immediately after lunch an inspection tour was taken through the Lucky Strike Plant, following which there was a choice of trips to the Richmond Filter Plant and Pumping Stations, the Richmond Meter and Distribution Shop, and the historic points in Richmond.

Ladies were made very welcome at the meeting cars with drivers being provided for them on Thursday, and a bridge with prizes being held on Friday.

Scheduled Papers

The Physiological Aspects of Public Water Supplies.....Sidney S. Negus
Keeping Good Water Good.....Linn Enslow
Discussion of preceding papers led by.....Richard Messer
What is New in Pumping.....C. E. Coleman
What is New in Distribution.....C. A. McGinnis and W. P. Cox
What is New in Metering.....Charles Bachman and Alan A. Wood
What is New in Coagulation.....Burton W. Graham
What is New in General.....W. W. Brush
I Will Pass It Along For What It Is Worth—Instructive Remarks by Reginald Blankenship, Chas. H. Bliven, Carl J. Lauter, Willard C. Lawrence, D. R. Taylor, and Richard F. Wagner

Wisconsin Section

The Wisconsin Section held the largest meeting in its history at Green Bay, Nov. 9–10. Registration totalled 190, including 60 Section members, 90 men guests, and 40 ladies. Headquarters was the Hotel Northland.

The program opened the morning of the 9th, Tuesday, the gathering being addressed at that time by Harry E. Jordan, secretary of the Association. The presentation of technical papers and their discussion continued through that afternoon and Wednesday, Tuesday afternoon being termed the "Health Session", Wednesday morning the "Operation Session" and Wednesday afternoon the "Construction Session", with appropriate grouping of the papers according to those headings. A general discussion followed each of these three sessions.

The Section's annual banquet was held on Tuesday evening in the Hotel, with the ladies present, and followed by entertainment.

The new officers of the Section elected for 1937–38 were announced as follows: chairman, William U. Gallaher of Appleton; vice chairman, W. C. Staeffler of Manitowoc; member of the Section's governing board, Albert E. Hintz of Oshkosh. Secretary-treasurer L. A. Smith was re-elected.

Scheduled Papers

Results of Air Conditioning Studies in Chicago.....Loran D. Gayton
Discussion.....Arthur H. Miller
Use of Diesel Engines in Water Works.....Bruno Nordberg
Discussion.....John Kuester
Pension Systems for Municipal Employees.....Robert Hanson
Discussion.....Walter A. Peirce
Wisconsin Public Service Commission Method of Computing Fire Protection Charges.....Robert Nixon
General Discussion
Trends in Water Purification.....H. E. Babbitt
Discussion.....L. F. Warrick
Research Studies in Water Purification.....J. McCarthy
Discussion.....James Meyers
Desirable Characteristics of a Public Water Supply....Jack J. Hinman, Jr.
Discussion.....F. A. Bull
Recent Well Improvements at Green Bay.....Harold L. Londo
Discussion.....V. Bruce Lundstrom
Removal of Fluorides from Potable Water.....J. A. Holmes
General Discussion
The Handling and Feeding of Activated Carbon.....Jerome C. Zufeldt
Discussion.....Frank C. Quimby
Use of Motor Driven Centrifugal Pumps.....Homer Binder
Discussion.....H. H. Brown
Reducing Unaccounted for Water in Cicero, Illinois
Frank J. Broz and George Diamond
Discussion.....W. C. Staeffler
Damage from Water Leaks.....Blaine Page
Discussion.....Thos. C. Dwyer
New Developments for Relief of Water Hammer.....L. H. Kessler
Discussion.....Wm. Homman, Jr.
General Discussion
Treatment of Lake Winnebago Water with Special Reference to Oshkosh and Neenah.....L. R. Howson
Discussion.....A. E. Hintz
What Every Water Works Operator Should Know About Corrosion
Charles H. Spaulding
Problems Encountered in Laying Water Mains and Services..L. W. Anderson
General Discussion

ABSTRACTS OF WATER WORKS LITERATURE

Key: JOURNAL of the American Water Works Association, **29**: 10 (1937). The figure 29 refers to the volume, 10 to the page of the JOURNAL and (1937) to the year of issue. If volumes of a publication are not paged consecutively but by issues, the figures **29**: 1; 10 (1937) indicate—volume 29, number 1, page 10 and 1937 as the year of issue. Initials *W. P. R.* signify that abstract is reproduced, by permission, from *Water Pollution Reports* (*British*).

WATER HAMMER

Editor's Note: The following are abstracts of papers which were contributed by the Hydraulic Division, A. S. M. E. for presentation at the second water hammer symposium, in cooperation with the American Society of Civil Engineers and the AMERICAN WATER WORKS ASSOCIATION at the annual meeting of the American Society of Mechanical Engineers held in New York, N. Y., December 6–10, 1937. Discussion of these papers will be published in the Transactions of the A. S. M. E. at a later date.

Air Chambers for Discharge Pipes. LORENZO ALLIEVI. Trans. A. S. M. E. **59**: 8; 651 (1937). The application of the general formulas of perturbed flow to the functioning of air chambers connected into discharge pipes is discussed. The law of oscillation of pressure rises and falls after the sudden stopping of the power actuating the pump is investigated. This law is expressed by relations which are functions of a single parameter representing the rates of the potential elastic energy of the air chamber and potential elastic energy of the piping. The influence of frictional resistance should not be neglected unless the volume of the chamber exceeds practical limits. Simple rules for the selection of chamber dimensions are found by means of approximate energy balances. The object of the study is the investigation of the problem of air chambers, their functioning as related to liquid friction and the determination of their volume, and of the additional frictional resistance required to insure their efficiency. The authors of preceding studies systematically neglected the consideration of the potential energy of the pipe line as compared to the analogous energy of the air chamber. The author proves that this is not correct and that the ratio of these two quantities of energy constitutes the parameter of the lows of pressure variations. A typical plant setup consisting of a pump, a suction pipe with a foot valve, and a discharge pipe equipped with an air chamber and feeding into a constant head reservoir is used for the studies. The discharge pipe is arranged to permit flow back from the reservoir. Two phases of hydraulic conditions following the stoppage of power to the pump are recognized; first the period during which the water flows on towards the reservoir, emptying the air chamber and second, the period during which the

flow is back from the reservoir. These studies are pursued by means of (a) the general laws of perturbed motion which tie together, for each layer, the pressures and velocities at intervals of phase (relations of acceleration); and (b) the physical laws (isothermic or adiabatic) which tie the pressure and the volume of the air contained in the chamber (volumetric relations). The author first treats the problem disregarding liquid friction and establishes a system of pendular relations of finite differences which rigorously define the laws of pressure at intervals of the phase. He then introduces in such a system, terms representing the resistance of liquid friction, and find, by a method of corrections, the new values of pressures dependent on such resistance. Finally, with the help of approximate energy balances, the author proposes rational rules for the selection of values to be assigned, in individual cases, to the volume of the air chamber and to the necessary resistance of liquid friction for descending flow.—*Homer Rupard.*

Air Chambers and Valves in Relation to Water Hammer. R. W. ANGUS. Trans. A. S. M. E., **59**: 8; 661 (1937). The phenomena accompanying the variable motion of fluids in pipes have been the subject of much study and investigation for years and have led to many solutions often inconsistent and unsatisfactory. It is now generally agreed that any change of velocity is accompanied by the motion of a pressure wave which travels along the pipe in both directions to and from its source and continues to move backward and forward till it is damped out by friction. Where the pipe is of uniform diameter and thickness the nature of these waves and the total pressures produced by them may be found readily, but where the thickness of the pipe varies and where it changes in diameter and has branches, the problem is much more complicated due to the separate systems of waves set up by each of these causes. It is quite possible to write mathematical expressions covering the case, but where the initial cause of the waves is somewhat irregular these expressions become difficult in the simple pipe and become so involved in systems of the ordinary type that the solution of them is far beyond the patience of the engineer even if he had the skill to work them. Therefore, the answers to the problems have frequently been obtained by empirical formulas, very limited in application and often leading to most erroneous results. Equations are given for the complete analysis of surge conditions in pump discharge lines. Graphs indicating water hammer conditions are presented for several types of discharge lines, such as simple discharge lines from pumps, discharge line with an air chamber some distance from the pump and also from the reservoir into which the line discharges, discharge lines wherein the water column breaks, and discharge lines wherein water hammer occurs due to the chattering or slamming of valves.—*Homer Rupard.*

Operation of Emergency Shutoff Valves in Pipe Lines. F. KNAPP. Trans. A. S. M. E., **59**: 8; 679 (1937). For operating the closing mechanism of a shutoff valve in case of a pipe rupture, a change of flow condition of a value reached only in such an emergency, is used. The pressure and velocity conditions in a pipe line must be examined in each specific case. Either pressure or velocity may be used to operate a tripping device, the choice depending on

which one will serve the particular installation best. For important installations, flow meters are installed at both pump and reservoir ends of the line. The automatic valve trips when the difference between the two meter readings reaches a predetermined amount. Special consideration must be given to cases where a Venturi tube is installed just below a safety valve at the upper end of a penstock. The Venturi tube may hamper the operation of velocity operated tripping devices. Emergency closing valves designed without consideration of water hammer conditions do more harm than good and may even cause accidents. A safety valve installation should be designed to (1) limit the pressure rise to a certain amount, uninfluenced by the quick closure or even slamming of the main valve and (2) operate rapidly enough to minimize the quantity of water discharged. These two requirements are seldom met in the usual installation. Emergency closing valves should permit quick closing under unbalanced pressure conditions. The valve must be free from vibrations under such conditions. Butterfly valves are generally superior to other types. They are quick closing, may be operated from several power sources, require relatively small force to operate, occupy least space and are least expensive. Control mechanism must be rugged and readily adjustable to care for free discharge conditions during closure. Emergency valve operation falls somewhere between two conditions; (1) where the pressure at the valve drops instantaneously to atmospheric and (2) where the pressure remains constant. The author proposes the use of two valves in parallel; a main valve, quick closing in a time equal to or less than the reflection time of the pipe and a smaller by-pass valve, arranged to close slowly, so that the first surge wave finds it open, acting as a surge supressor. The size of the by-pass is determined by the maximum permissable surge. The closing rate of the by-pass valve is determined by the necessity of limiting the discharge after a break to a minimum. Anyone of several types of valves may be readily used for the by-pass. The author carries through calculations for the proportioning of such a combination of valves for a given installation.—*Homer Rupard.*

Complete Characteristics of Centrifugal Pumps and Their Use in the Prediction of Transient Behavior. R. T. KNAPP. Trans. A. S. M. E., **59**: 8; 683 (1937). Comparison of the operating conditions of hydraulic-turbine and centrifugal pump installations shows that the pumps are subject to much wider and more involved variations than are the turbines; especially during the transient state of starting, stopping or emergency operation, such as reverse rotation. In case of reverse rotation the machine ceases to be a pump and becomes a runaway turbine. This variation in performance gives rise to many questions, such as the runaway speed of the machine as a turbine, the time of reversal, the magnitude of the accelerating forces, the effect of the surge cycle in the discharge line, the maximum and terminal reverse rates of flow, and so on. The object of the study was to explore these little known regions of performance and to attempt to use the resulting information to answer some important questions. Laboratory experiments were carried out on a 4″ high-head high-efficiency pump, connected up to an electric dynamometer which could be operated either as a motor or generator up to speeds of 3500 r.p.m. The experiments were a series of constant speed runs, with the discharge varied

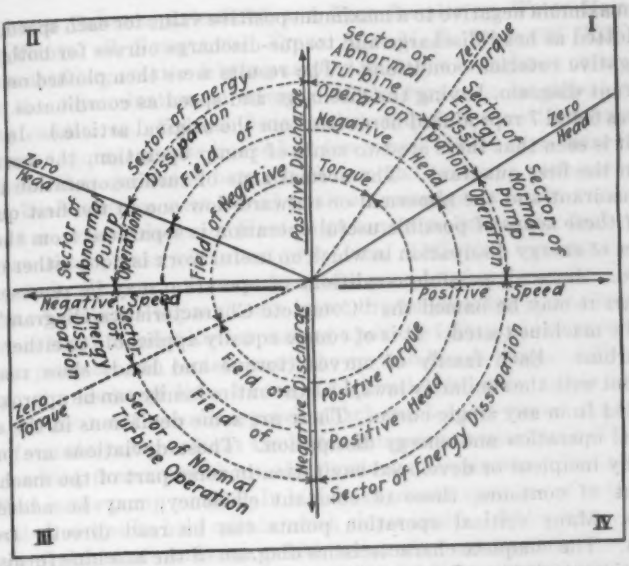

FIG. 6 EXPLANATORY CHART FOR COMPLETE CHARACTERISTICS DIAGRAM

Courtesy of A. S. M. E.

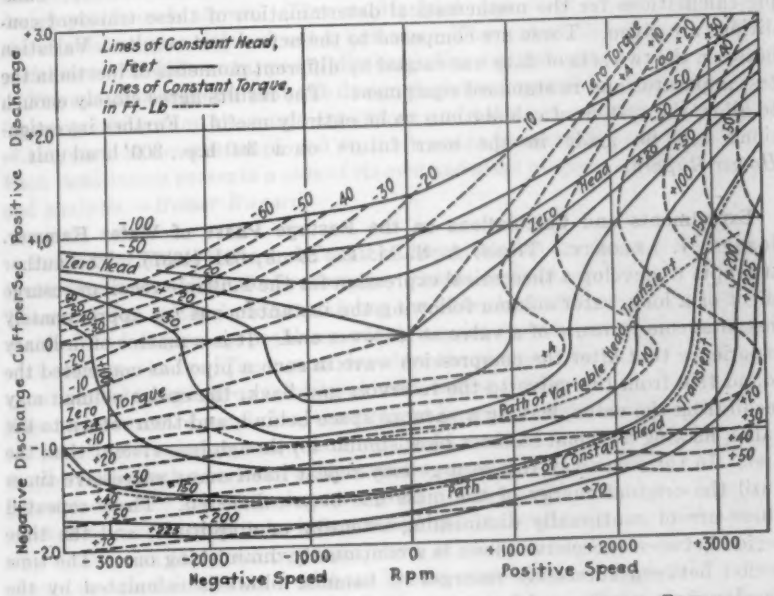

FIG. 7 COMPLETE CHARACTERISTICS DIAGRAM FOR 4-IN. DOUBLE-SUCTION PUMP

Courtesy of A. S. M. E.

from a maximum negative to a maximum positive value for each speed. These were plotted as head-discharge and torque-discharge curves for both positive and negative rotation conditions. The results were then plotted on a single 4-quadrant diagram, having the discharge and speed as coordinates. (Refer to figures 6 and 7 reproduced herewith from the original article.) In this diagram it is seen that there are two zones of pump operation, the normal one being in the first quadrant. The normal zone of turbine operation is in the third quadrant and the abnormal or outward-flow one in the first quadrant. Each of these zones of possible useful operation is separated from the others by zones of energy dissipation in which no useful work is done either on or by the fluid. Since all possible conditions of operation may be represented on this chart it may be named the "Complete Characteristics Diagram" of the hydraulic machine tested. It is of course equally applicable to either a pump or a turbine. Each family of curves (torque and head) show reasonable agreement with the similarity laws, i.e., the entire family can be approximately calculated from any single curve. There are some deviations in the zones of abnormal operation and energy dissipation. These deviations are probably caused by incipient or developed cavitation in some part of the machine. A third set of contours, those of constant efficiency, may be added to the diagram. Many critical operation points can be read directly from the diagram. The complete characteristics diagram of the machine furnishes the information needed to calculate the surge. Such information will enable the designer to determine with surety whether relief or quick closing valves would be necessary in the system and if so then complete time characteristics. Sample calculations for the mathematical determination of these transient conditions are given. These are compared to the actual test results. Variation between the two sets of data was caused by different moments of inertia in the test apparatus and in standard equipment. The results agree closely enough to allow the system of calculations to be entirely useful. Further investigations will be made in the near future on a 300 h.p., 300′ head unit.—*Homer Rupard.*

Experiments and Calculations on the Resurge Phase of Water Hammer. JOSEPH N. LECONTE. Trans. A. S. M. E., **59**: 8; 691 (1937). The author attempts to develop a theoretical expression for the multiple recoil or resurge effect of a long water column following the instantaneous (or approximately instantaneous) closure of a valve at its lower end. It is a matter of ordinary experience that after the compression wave in such a pipe has completed the round trip from the valve to the reservoir and back, the entire column may recoil from the valve, leaving a vacuous space behind, and then return to the valve, making a second hammer blow similar to, though less violent than the first. In the same way this resurge may repeat itself many successive times until the original energy of the mass has been exhausted. These repeated blows are of continually diminishing intensity or amplitude, and the time period between successive blows is a continually diminishing one. The time period between successive resurges or hammer blows is calculated by the developed expression and is compared with time periods recorded from tests by an oscillograph. The computed and observed results are presented in tabular and graphical form for several of the tests.—*Homer Rupard.*

Comparison Between Calculated and Test Results on Water Hammer in Pumping Plants. O. SCHNYDER. Trans. A. S. M. E., 59: 8; 695 (1937). The development of large motor driven pumping units has brought on an increasing need for the determination in advance of the surges to be expected under operating conditions. Several Swiss pump manufacturers have completed large pumped storage plants in the last few years. When tests were made on these plants the agreement between theory and test was reasonably satisfactory. Discrepancies were traced to air entrainment or faulty instruments. Agreement was much closer for plants with long pipe lines under high pressure than in low head plants with short pipe lines. Difficulty was experienced in getting sufficiently accurate pressure readings on low head plants. The most important water hammer problem in motor driven pumping plants is the surge condition in the discharge lines occurring upon the failure of the power supply to the pump motor. In certain cases the suction line is long enough to cause difficulty. In discharge lines having a high velocity under a low head it is possible, by the use of an ordinary swing back check valve placed at a sufficient distance from the pump to limit the water hammer to a maximum of twice the normal working pressure without any particular requirements for heavy flywheel effect in the pump motor. In high head plants, economy of construction requires that surges be held within much closer limits. The author discusses the different phases of conditions which occur after a power failure, describes the action that takes place and shows the effect of different types of equipment upon these conditions. The cases of a line equipped with a relief valve and one without a relief valve are analyzed. The application of the principles to design problems is shown. Test results from one plant are compared with the calculated quantities of water hammer. The test results show the actual performance of different types of discharge line equipment.

The author concludes that the design engineer now has the means whereby he can predetermine the surge conditions and calculate accurately the effect of the various devices employed to limit water hammer in pumping plants. Each installation presents a case of its own and must be given individual study and analysis.—*Homer Rupard.*

Relation of Relief Valve and Turbine Characteristics in the Determination of Water Hammer. EARL B. STROWGER. Trans. A. S. M. E., 59: 8; 701 (1937). The graphical method of determining the water hammer pressure in pipes is usable in solving many problems which require considerable time and labor with other methods. The method involves the plotting of sets of simultaneous equations relating flow or velocity to head, taking the form of a series of stright lines and a series of parabolas, the straight lines representing the pressure due to direct and indirect water hammer blows and the parabolas representing discharge through a series of orifices under varying head. To obtain accurate determination of the water hammer pressure which may take place in a penstock it is necessary to take into account in the computations all the factors which influence the discharge-time curve of the penstock. In the case of a simple penstock installation without branch connections, surge tank or relief valve, etc., this would involve (a) the gate discharge rating curve of the turbine; (b) the gate-time curve of the turbine, and sometimes (c) the speed-discharge curve of the turbine although in most cases this last factor may be

omitted. In the case of a unit with a governor operated relief valve, the gate-discharge and gate-time curves of the valve must also be known. The action of the turbine must be related to that of the valve to fix the maximum water hammer which may be obtained. The author gives sample calculations and diagrams for a 54″ governor operated relief valve installed on a 29,000 h.p. hydraulic turbine. Calculations are with friction neglected and with friction considered. The calculation with friction considered is approximate because it assumes all the friction concentrated at one point. Velocity head at the entrance to the turbine may be combined with the friction loss if it is desired to include it in the calculations. The sample calculation shows a pressure rise of 32% neglecting friction and 28% if friction is taken into account. The shape of the gate discharge curve and the nature of the gate motion may result in an increased penstock velocity at the outset, accompanied by a negative pressure wave. Pressure-rise tests were made on the unit for which the calculations were prepared. The velocity of the pressure wave was determined as 2400 ft. per sec. Test values for pressure rises were determined for six gate openings. The curve drawn through these points was 4 to 5% higher than the curve for the computed values. The two curves had similar shapes.—*Homer Rupard.*

The Application of Heaviside's Operational Calculus to the Solution of Problems in Water Hammer. F. M. Wood. Trans. A. S. M. E., 59: 8; 707 (1937). Heaviside's operational calculus has been used extensively in connection with electrical surges in transmission lines. Since the subject of water-hammer is an analogous one, it may prove amenable to similar applications of the method. There are certain limitations of the method which should not handicap the application since all theories suffer from similar shortcomings. In the practical solution of particular cases many conditions of an indeterminate nature are present. In hydraulic problems, approximations are necessary because of the inability of the mathematical theory to solve complete flow equations and because of peculiar characteristics of hydraulic machines. In spite of limitations this method is useful in clarifying many surge problems and in verifying some truths which have already been established by other methods. The article does not attempt to cover the entire field of surge problems, but does introduce this valuable tool to the hydraulic fraternity. Various examples of application are given to demonstrate the use of the method.—*Homer Rupard.*

DISTRIBUTION—MAINS, VALVES, TANKS AND RESERVOIRS

Providing for Expansion in Water Mains. A. P. Malley. Eng. News-Rec., 119: 428 (1937). Providing adequate fresh water supply for Golden Gate International Exposition was complicated by fact that location is on island in San Francisco Bay. Site can be served to good advantage by gravity flow from reservoir on Yerba Buena Island, which rises to height of several hundred feet above tide level, but problems arose in connection with pipe line that would deliver water to reservoir. Most logical route was across suspension spans of Bay Bridge, necessitating numerous joints which could take up movements of as much as 30″. The somewhat unusual solution of the problem

is described. Fire protection requirements dictated pipe diameter of 10″. Pressure on bridge will vary from 50 to 150 lbs. per sq. in. Two major requirements had to be met by expansion joints on bridge: (1) absorption of any movement in either pipe or bridge at points where there are expansion joints in bridge structure and (2) absorption at intermediate points of movement arising from differential expansion and contraction between bridge and pipe line. Two types of expansion joints were employed. Simpler of two, used for differential expansion on bridge runs, employs modified arrangement of commercial joint in which gland is drained so that discharge of any leakage may be controlled. This type of joint could not be used at ends of long spans, because here pipe would be subject to movement in both vertical and horizontal planes. Design adopted is transverse pipe connection arranged so that 30″ horizontal movement is converted into small angular deflection (3.5°) in alignment of main and transverse pipes where provision is made for absorbing this movement in spherical joints of special design, which were made 8″ in diameter to materially reduce weight and cost. Details of design given.—*R. E. Thompson.*

Extent of Frost Penetration in Soils. ANON. Eng. Cont. Rec., 50: 89; 11 (1937). Data from a bulletin recently issued by National Research Council of Canada and published by Water Works Information Exchange, Canadian Section, A. W. W. A., is given in tabular form.—*R. E. Thompson.*

Evaporation Loss in Covered Reservoirs. A. A. YOUNG. Eng. News-Rec., 119: 432 (1937). Details are given of 11-month test period on 200,000-gal. covered reservoir in La Verne, California, which is 60′ in dia. and 10′ deep. Water supply, from underground sources, has uniform temperature ranging from 74°F. in summer to 70° during winter. Protective structure consists of circular frame wall with tar-paper roof sloping to peak in center. Wall is 5.5′ high, with upper 14″ screened for ventilation. Tank is within few feet of other buildings but is completely exposed to sun and wind on south and east sides. Two standard Weather Bureau pans were used in obtaining evaporation data: floating pan was used in reservoir and land pan outside. Monthly rates of evaporation are shown graphically. Difference in evaporation inside and outside reservoir was 28.96″ for period June 1, 1935–April 3, 1936. If generally accepted coefficient of 0.70 is applied to evaporation from land pan to reduce it to reservoir value, saving becomes 13.7″. This is not sufficient, if value is capitalized, to pay cost of roofing. Principal benefit lies in preserving purity of water.—*R. E. Thompson.*

Elevated Tank Improves Pressure in Montgomery, Alabama, Water System. ANON. Eng. News-Rec., 119: 570 (1937). Water works extension program, involving expenditure of $339,274, now nearing completion includes 1-mil. gal. elevated tank of radial girder design in which maximum variation in depth is only 25′. Tank has equalized pressure throughout city and has doubled pressure in higher residential areas. This, it is expected, will result in reduction of fire insurance rates. New scheme also includes 7 artesian wells of combined capacity of 4 m.g.d. Old air-lift-operated wells are being aban-

doned except for standby service. It is estimated that new modern electric pumps will effect saving of $7,500 per year. Distribution system is being extended by addition of 14 miles of cast iron mains.—*R. E. Thompson.*

Sulfur Compounds as Pipe Jointing Materials. C. R. PAYNE. Eng. Cont. Rec., 50: 93; 14 (1937). Improvements made in physical and chemical properties of sulfur base cements and use of these cements in sanitary engineering are reviewed. Grading and type of aggregate used in manufacture is of first importance, strength increasing as percentage of voids in aggregate decreases. Cements of greatest tensile strength are obtained by mixing 40% sulfur and 60% aggregate but product is too thick for use in practice: for practical reasons, therefore, cements containing 55–60% sulfur are employed. The interfacial tension between sulfur and aggregate determines adhesive and wetting properties of the cement and these surface effects may be modified by addition of material such as naphthalene or carbon black. It has been found that the permanence and physical characteristics are greatly improved by addition of 1% or more of an olefine polysulfide, a plastic product resulting. An accelerated test of durability consists of immersing figure-eight briquets of the cements in boiling and ice water alternately for 5 minutes. The cements are inert to acids and resistant to acid salts, suggesting their application in equipment for handling ferric chloride or other solutions which disintegrate concrete. Sulfur cements were first used to join bell and spigot pipe about 25 years ago and they are being increasingly used as substitutes for lead due to saving effected in material and labor and their superior tightness. Their resistance to vibration and temperature changes is also greater than that of lead. Only disadvantage is initial leakage, which decreases in short time until absolutely dry and permanent joint is obtained. This disadvantage may be practically eliminated when cements made from plastic sulfur are used.—*R. E. Thompson.*

New Reservoir and Water Tower at Chester. ANON. Civ. Eng. (Br.), 32: 293 (1937). The reservoir is a reinforced concrete structure, of irregular shape, with a capacity of 10,000,000 Imp. gallons and a depth of 10 ft. 6 in. The floor is laid in panels 138′-8″ by 19′-10½″, in two thicknesses, the bottom slab being 4 in. thick and the upper slab 3½ in. thick. The roof is of beam and slab construction, supported on 8-in. square concrete columns. The reservoir is fed by a 15″ c.i. inlet main and a 24″ c.i. outlet main. A reinforced concrete control tower and elevated storage tank has been erected to a height of about 90′ giving an elevated storage, in a concrete tank, with a capacity of 200,000 Imp. gallons.—*H. E. Babbitt.*

Some Essentials in Management of Water Distribution Systems. WILLIAM T. FIELD. Public Works, 68: 9; 32 (1937). The functions of distribution system are to provide for domestic consumption water of high sanitary quality agreeable in taste and of pleasing appearance; for fire protection; and for water of the quality and quantity needed for industrial and commercial uses. Intelligent planning for future extensions and additions necessitates gathering information concerning past rates of water consumption, capacity of source of

supply, carrying capacity of mains and feeders, pressure in system, fire protection facilities, etc. Generally speaking, no pipe less than 6″ should be installed in system to which fire hydrants are connected. Additional suggestions are given on subjects: cleaning and flow capacity, leaks, laying pipe, gate valves, hydrants, servicing different levels, metering, storage and reserve.—*Martin E. Flentje.*

A Few Kinks. D. R. TAYLOR. W. Wks. and Sew., **84**: 190 (1937). Careful partial opening and closing sticking valve may free it. Hidden valve and meter boxes and leaks may be found after the first light snow. Iron service pipe installation by pushing is often aided by water jetting. Methods for locating stub services and house leaks are described.—*H. E. Hudson, Jr.*

Leakage Losses. M. UDWIN. W. Wks. and Sew., **84**: 349 (1937). The Rand Water Board furnishes water to municipalities and industries within the area of the Witwatersrand Gold Fields of South Africa. Non-corrosive water, largely drawn from the Vaal River and treated, is lifted more than 1000′, and distributed through 342 miles of steel mains and 533 meters to a total population of 1,100,000. Out of a total of 27.53 m.g.d. (Imperial), leakage for 1935 was only 1.344%, and part of this was water used for scouring mains and cleaning reservoirs. Terrain is such that leaks are readily apparent, and this combined with 100% metering and daily patrol of entire distribution system accounts for ability to keep leakage small. Any leaks are immediately repaired.—*H. E. Hudson, Jr.*

A Well-Conceived Emergency Truck Built by a Water Utility. FELIX SELIGMAN. The American City, **52**: 10; 69 (1937). Emergency service truck designed, constructed and fitted out by a Water Department. In addition to a universal power drive for valve closing, it contains a large variety of tools and equipment for use in any imaginable breakdown of the water supply distribution system.—*Arthur P. Miller.*

Floating a Water Intake into Place. ANON. Eng. News-Rec., **119**: 473 (1937). Construction of 2 intakes of 12″ and 20″ steel pipe, extending more than 600′ into Lake Erie, for Union Salt Co. in Cleveland is described. Pipe ¼″ thick, spirally welded, was purchased in 40′ lengths and coupled on shore into 120′ sections, which were floated into position as each section was added and finally allowed to settle into previously excavated shallow trench, 17′ below water surface. Equipment used consisted of floating crane and crawler crane on shore. Laying was completed in 1 day, after pipe had been coupled in 120′ sections. Couplings employed were standard make of flexible joint of sleeve type construction, harness bolts being used to securely lock adjoining sections together.—*R. E. Thompson.*

Handling Emergency Main Repairs. HENRY E. NUNN. Can. Engr., **73**: 8; 9 (1937). A brief general discussion. There are 3 important factors in emergency work: getting on the job promptly, competent men and equipment in good condition, accurate and dependable records of the distribution sys-

tem. After each job, all equipment should be put in condition for immediate use on the next call. Consumers' good will is promoted by prompt notification of intention to shut off a main for repairs and by giving them some idea of the period of time that water will be shut off. Fire department should also be kept informed. Sound maintenance will lessen the number of emergency calls.—*R. E. Thompson.*

Leakage Tests. ANON. Eng. News-Rec., **119**: 561 (1937). It is noted in annual report of Thomas Brooks that test on cement-jointed 30″ main in Los Angeles indicated average leakage of 3.28 gal. per inch diam. per mile of main per day, compared with 100-200 gal. allowed for lines installed by contractors. —*R. E. Thompson.*

Mipolam, a New Material for Water Pipes. L. W. HAASE. Ges. Ing., 60: 150 (1937). Shortage of metals forces Germany to search for replacement materials that can be produced from raw materials available in the country. Mipolam is such a new artificial material from the series of thermoplastics from polyvinylchloride. The raw materials are coal, limestone and chlorine. Mipolam has a specific gravity of 1.38 and a tensile strength of about 8,500 lbs. per square inch. These properties allow an economical use of Mipolam even if its cost per pound is much higher than that of iron, copper or lead. Mipolam does not burn, has a low conductivity for heat, and is not attracted by acids nor bases, yet gets plastic in heat above 80°C. Pipes made from Mipolam can be easily worked by saws and files. Joints can be made by heating one end, forming it into a bell, pushing the other pipe in it and gluing it with a solution of Mipolam in an organic solvent. Tees can be made in a similar way. Bending is done with heated pipes filled with sand.—*Max Suter.*

PUMPING

Costs of Pumping Compared. D. R. MARTIN. Am. City, 52: 8; 69 (1937). When Rock Island, Illinois, had to improve their pumping plant a comparison of operating costs between their present hand fired boilers, stoker fired boilers and electric driven pumps was made. It was found that a stoker installation might have saved about $2000 per year while the electric motor driven pumps would save 2.66 times that of the stoker installation.—*Arthur P. Miller.*

Axial Flow Pumps have Large Field of Application for Low-Head Pumping Installations. ANON. Eng. Cont. Rec., **50**: 85; 7 (1937). Axial flow pump particularly suitable for low-head, high-capacity installations. Unit with elbow discharge is especially applicable to vertical settings where it is desired to have impeller submerged and discharge pipe located well above suction level. From mechanical point of view, axial flow pump is very simple. Relatively short pipe forms throat for impeller and has cast integrally with it a set of guide vanes which join at center to form housing for water-lubricated bearing. Housings for stuffing box, motor base and pump feet are cast integrally with discharge elbow. Pump is also readily applicable for horizontal setting, in which case it is mounted on common base plate with the motor. Curves are given showing test results on 12″ unit.—*R. E. Thompson.*

Pointers on the Selection of Pumps for Water Works Purposes. ANON. Eng. Cont. Rec., 50: 89; 7 (1937). The significance of suction lift, specific speed and cavitation is discussd and illustrated by graphs. These factors are closely related and their combination forms the dominating criterion in selection of type of pump most suitable for given conditions. For selection of most suitable centrifugal pump for specific purpose, not only the driving motor speed and price, but also operating sigma value (cavitation factor) corresponding to maximum suction lift, are deciding factors in choice of specific speed and, therefore, the type of pump.—*R. E. Thompson.*

Reducing Head Loss and Slam in Check Valve Installations. GEORGE A. SHIPE. Eng. News-Rec., 118: 376 (1937). Head loss in pump check valves is shown to be considerable, increasing pumping costs. Device to eliminate this loss and prevent slam was developed which consists of spring attachment on disc lever of valve which is held in open place by latch cam operated by combination holding and releasing solenoid connected with pump motor electric circuit. On shutting down pump, or in case of power failure, solenoid immediately becomes deenergized; this permits core of solenoid to strike latch which releases valve disc so that it can be carried quickly and quietly to its seat by spring on lever arm. Slam is positively eliminated because spring arrangement can be timed to close disc at instant column of water comes to rest. Device also permits adjustment of valve opening lever so that when mechanism is in operation the disc is lifted and held out of stream flow entirely; this is big factor in head loss reduction. Such installation has given reliable service for 18 months on 6-inch check valve: head loss has never exceeded 1 foot, although velocity of flow reaches 12 feet per second.—*R. E. Thompson.*

WELLS AND GROUND WATER

22 m.g.d. from Two Deep Well Pumps. ANON. Eng. Cont. Rec., 50: 85; 24, 26 (1937). Two of largest and most powerful deep well turbine pumps on record, installed in Ray St. pumping station as part of 60 m.g.d. extension to water supply system of Spokane, Wash., are described. Each unit will deliver 7,500 g.p.m. against head lift of 420′ and consists of 6-stage, 24″ pump with 20″ discharge column and 4″ line shaft in 10′ sections, driven by 900 h.p., 2,300-volt, 3-phase, type CW wound rotor, slip ring motor operating at 1,175 r.p.m. The bronze impellers are adjustable, semi-open type. Lubrication is with water. Pump bowls and suction bells are porcelain enameled inside to reduce friction losses, and discharge column is coated inside and out with spun hot bituminous coating. Safety and protective electrical devices have been incorporated and pumps are equipped for automatic remote control from float switch in reservoir. Overall wire to water efficiency is 80% and estimated operating cost is $\frac{8}{10}$ cent per 1,000 gal. of water pumped.—*R. E. Thompson.*

Changes in the Composition of Ground Waters Resultant of Anaerobic Sulfate Decomposition and the Attendant Precipitation of Calcium and Magnesium. FRANK M. EATON. Trans. Am. Geophys. Union, 1936: II; 512. Studies in San Joaquin Valley, California, indicate that drainage waters from irrigation

projects are always more saline than the irrigation water and percentage of sodium is quite regularly higher. Some calcium and magnesium is precipitated in soil as carbonate.—*R. E. Thompson.*

Chemical Examination in the Hygienic Evaluation of Well Waters. KÁROLY BOLBERITZ. Hidrol. Közlöny, 16: 52 (1936) (in German). Data on 6833 well waters analyzed in Royal Hungarian Institute for Public Health were studied. Oxygen consumption up to 1.5 p.p.m. has been considered an indication of good water, up to 2.5 acceptable water, under 4.0 an indication of slight infection and over 4.0 a high degree of infection. Corresponding values for chloride were 40, 80 and 150 p.p.m.; for nitrate as N_2O_5, 40, 80 and 150; for nitrite as N_2O_3, 0.1, 0.2 and 2.0; and for ammonia as NH_3, 0.1, 0.2 and 1.0 p.p.m. The waters were distributed on above basis into groups, i.e., good, acceptable, one objectionable component, two, three and more than 3 objectionable components. Comparison with bacteriological investigations showed that of waters judged potable according to chemical data, 32.7% were coli-positive. Ratio of coli-positive waters continually increased in the groups, reaching 70.5% in group containing more than 3 objectionable components. The higher the number of objectionable chemical constituents the larger must be the measure of infection and the higher the possibility of presence of pathogenic bacteria. Simultaneous presence of ammonia, nitrite or nitrate and high oxygen consumption shows high probability of infection.—*R. E. Thompson.*

Unusual Difficulty with a Well at Cuyahoga Falls. JOHN S. GETTRUST. Ann. Rept. Ohio Conf. Water Purif., 1936, 77. The water supply, which is derived from three 12″ wells, 80′–130′ deep, located at edge of pool formed by small dam on the water works property, has been practically sterile and free from gas-forming bacteria since placed in operation in 1920. Suddenly, the bacterial count increased and positive *E. coli* tests were obtained, trouble being traced to one well which when backflushed allowed air to come up in the pond, indicating that the layer of clay which protected well from surface water was apparently broken through. Chlorination was immediately adopted and about 2 months later the floor of the well house dropped about 6′. Water had evidently come up along casing during periods of backflushing, washing out clay and soil under pumphouse.—*R. E. Thompson.*

Problems Resulting from Quick Sand. Ann. Rept. Ohio Conf. Water Purif., 1936, 81. At Oak Hill, as described by T. R. Lathrop, so much sand was pumped from well that settlement of pumps and concrete slab put casing out of plumb and caused abandonment of well. Much sand is being pumped from other wells. To remedy difficulty, large dug well with usual strainers replaced by porous concrete sections is planned. C. G. Milford reported that silt in well water at Rittman covers surface of zeolite in softening units, increasing loss of head and making frequent backwashing necessary. During past summer, units had to be bypassed on several occasions.—*R. E. Thompson.*

WATER SUPPLY—GENERAL

Distribution System Operation. ANON. The American City, 52: 9; 81 (1937). A description of the water supply distribution system of Honolulu,

Hawaii, together with the problems involved in its extension and maintenance. —*Arthur P. Miller.*

New Concrete Reservoir for Vernon, B. C. A. C. WILDE. Can. Engr., 73: 11; 3 (1937). Construction of a 2.5-mil. gal. reservoir, using relief labor, is described. Reservoir is 70′ wide, 170′ long and 15.5′ deep, with side slopes of 1:1. Excavation amounted to approximately 13,600 cu. yds. Side walls were covered with 5″ of concrete, Kautex expansion joints being provided at intervals of 30′, and bottom was filled to depth of 1′ with large rocks and covered with about 4″ of cement. Water for reservoir is pumped from Kalamalka Lake through small adjoining reservoir, the new pumping equipment consisting of 2-stage centrifugal pump driven by induction motor, capacity being 1,000 g.p.m. Completion of project increases storage to 25 mil. gal., considered ample for number of years to come. Capacity of new reservoir can be increased to 20 mil. gal. when required.—*R. E. Thompson.*

Singapore Water Losses Held to Low Figure. ANON. Eng. News-Rec., 119: 474 (1937). In annual report of water department, D. J. Murnane states that 95.1% of water delivered to distribution system from the two purification plants was accounted for in 1936. Average daily consumption is 17 m.g.d., 93.5% being metered and 1.6% (fire fighting and main flushing) estimated. Assuming meter under-registration at 3%, remainder of unaccounted for water represents leakage of less than 80 gals. per inch mile per day from distribution system.—*R. E. Thompson.*

The Water Works of Charlottetown. J. A. MACMILLAN. Eng. Cont. Rec., 50: 85; 19 (1937). Water supply of Charlottetown, one of the two publicly owned systems in Province of Prince Edward Island, is derived from wells. System is operated by commission of three, elected every 2 years, members receiving nominal salary. Commission, which also directs operation of sewer system, is entirely distinct and separate from city administration. Operating surplus is paid to city treasurer each quarter but, according to Water Works Act, this must be used for water and sewer purposes only. There are 3,000 services, supplying 15,000 people. Flat rates for domestic consumers are collected quarterly in advance; industrial and commercial metered services are billed monthly. Services, 99% of which are lead pipe, are paid for by department to property line; when service larger than ¾″ is requested, consumer pays difference in cost. Construction of system and extensions were financed by bond issues totaling about $500,000; bonds to amount of $300,000 have been retired and operating surplus is sufficient to take care of all outstanding and future bond issues. Daily analyses are made by Provincial Health Dept. Although not one case of illness has been traced to water supply in 50 years, treatment is being seriously considered.—*R. E. Thompson.*

Water Works Problems of Port Stanley, Ont. W. G. BREEN. Eng. Cont. Rec., 50: 85; 11 (1937). Infiltration basins on shore of Lake Erie and first intake installed to supply water to Port Stanley, Ontario, proved unsatisfactory. Present system consists of 12″ intake extending 1,600′ into 20′ of water, dry feeders for alum, coagulation basins constructed out of the old infiltration

basins, 2 pressure filters and chlorination equipment. The lake, which is shallow, is subject to sudden, wide variations in turbidity. Population of town, which is a summer resort, varies from 800 to 4,000. Maximum daily demand is 7 times the average daily demand.—*R. E. Thompson.*

History of the Alliance Water Supply. A. E. Hess. Ann. Rept. Ohio Conf. Water Purif., 1936, 73. The water supply of Alliance, Ohio, has been derived from the Mahoning River since 1883, an impounding reservoir and filter plant being constructed in 1913. The water is highly polluted and in summer temperatures of 24–25°C. and tastes and odors render the water unpalatable, although latter have been successfully combated with activated carbon. In 1935, a 1.5 m.g.d. well was constructed which is now supplying approximately ½ of supply at temperature of 4–5°C. Tastes and odors have not been experienced since, but the hardness of the supply has been increased about 70 p.p.m. The well water is aerated in coke trays for iron removal and then mixed with river water treated with chlorine and alum. Contract has been awarded for construction of 2 more wells.—*R. E. Thompson.*

ADMINISTRATION AND PERSONNEL

Planned Publicity for City Water Works. Anon. The American City 52: 9; 57 (1937). A description of the origin, development and contents of pamphlets issued by the Milwaukee (Wis.) Water Works. The pamphlets are given to public school and university students to stimulate interest in this branch of municipal government.—*Arthur P. Miller.*

University and City Cooperate in Furthering Sanitation Research. Anon. Eng. News-Rec., 119: 483 (1937). New sanitary engineering research laboratory at College of Eng. of New York University, as result of agreement between Dept. of Sanitation of N. Y. City and the University, will provide unusual opportunities for studying sanitation problems of special interest to city, provide for training of selected municipal employees, and enable college to carry on broader program of educational service and research. Plant, which was constructed as WPA project, includes chemical and bacteriological laboratories, tanks, pumps, meters, etc., and 25,000 g.p.d. rapid sand filter (3 feet square). Laboratory work will be under direction of Thorndike Saville, assisted by Lewis V. Carpenter.—*R. E. Thompson.*

Supervising Texas Waterworks. Chester Cohen. Eng. News-Rec., 119: 559 (1937). Supervision by State Dept. of Health includes (1) licensing of operators, (2) quality rating of supplies and (3) posting of approval signs on the highways. Licensing is entirely voluntary. All operators on either production or distribution who have direct connection with actual management of water supply units are eligible to apply for license if they have had 1 year's experience: billing clerks, cashiers or drivers are excluded. Licenses are divided into 3 groups, A, B, and C, and operator cannot apply for higher grade until he has passed lowest, or grade C. To insure continued study and development, grade C certificate expires in 3 years. There are no fees. To date, over 400 licenses have been issued and entire water works profession is in favor

of the program. Rating schedule is based largely on that of E. Sherman Chase. Any city with supply that has a rating of 92 points out of total of 100 may erect a water supply approval sign on highway entrances. A licensed operator in charge of the plant contributes 8 points to score: approval therefore necessitates employment of licensed operator. Average grade of almost every city on first inspection is 35, on second inspection 75 and third inspection is usually all that is necessary to ascertain that defects have been corrected and that supply warrants official approval. Up to the present, 499 cities have been rated. There are 772 public supplies, 615 from wells and 157 from surface sources. Highway approval markers have been authorized in 29 municipalities.—*R. E. Thompson.*

What's Ahead for Public Service Personnel. HARRY E. JORDAN. Ann. Rept. Ohio Conf. Water Purif., 1936, 10. An informative discussion of trends in modern-day government and possible effects on those engaged in public service, particularly in the technical and engineering branches. The man engaged in the operation of a unit of a water plant, or similar public service, should vow himself to "steadfastness" in that duty. There is a higher obligation than that to the particular group of which we are a part: it is to the public whom we serve. If there are any men engaged in operation of water plants who hold that to improve their condition, they are entitled to jeopardize the safety and life of the people they serve by preventing the furnishing of that service, such men should withdraw and engage themselves in some line of work where the strike is one of the accepted weapons of group action. However, there are several types of organized action which public service personnel can engage in, promote, or coöperate with, all leading to improved status, more adequate recognition and greater economic stability than now obtain: (1) There should be associated together, in groups such as the Ohio Conference, the personnel of every type of public service to consider technical and professional problems, promote exchange of information and experiences and provide for as much self training as the interests of the group will permit. (2) There should be established, first by voluntary agreement and later by regulation of competent authority or by legislation, a schedule of minimum requirements for entrance to the service as well as a system of periodical reexamination for purpose of demonstrating continued ability. (3) There should be promoted a system of demotion or separation from the service. (4) Retirement systems should be set up. (5) There needs to be developed an "esprit de corps" similar to that of the British civil servant, who is not alone loyal to his service and to his associates, but will not "let his chief down."—*R. E. Thompson.*

Report of Committee on Licensing Water Works Employees. W. C. LAWRENCE, P. J. O'CONNOR AND N. J. HUMASON. 16th Ann. Rept. Ohio Conf. Water Purification, 1936, 7 (1937). No legislation is necessary at present time to put licensing into effect in Ohio as the statutes give the State Dept. of Health the necessary power to protect all operators in retaining their positions. Those eligible and the objects and benefits expected to be derived from licensing are outlined and following recommendations are made: (1) That State

Dept. of Health issue certificates to employees for period of at least 1 year with renewals granted annually. (2) Proposed classification of operators, such as first, second, third and fourth class operators, depending upon their position, qualification, size and kind of plant, classification to be determined by State Dept. of Health, and with recommendations from the superintendent in case of larger plants. (3) That no employee can get a higher classification unless he has served in lower bracket and has passed the necessary examination to move up. (4) That short schools be established at engineering colleges, where employees can be educated and examined periodically. (5) Chief Engineer of State Dept. of Health and the college instructor to agree on type of examination and grading of different classifications.—*R. E. Thompson.*

DAMS

WPA Dam Fails at Kansas City. ANON. Eng. News-Rec., 119: 495 (1937). On September 20, the Wyandotte County Lake earthfill dam near Kansas City failed by slumping or dropping of downstream bank for half length of structure. Foundation failure is believed to have been responsible. Planned to impound recreation lake of 300 acres, the 84′ high earthfill, extending 1,550′ across bed and valley of Marshall Creek, was nearing completion when about half downstream face extending 800′ from centerline to one abutment slumped as much as 50′. Dam is 550′ wide at base and about 50′ wide at 80′ level to which it had been built. It has puddled clay core and was constructed of clay placed in 8″ layers and compacted with sheepsfoot rollers. Fill was still in as-rolled condition, having had no chance of being saturated either by rains or impounded water. Foundation material is reported to be soft blue shale or clay with interspersed sand lenses. Preliminary borings had indicated it to be a hard and impervious shale and dam was designed on that basis. In May, 1936, however, work was halted when material was found to be much softer than expected, behaving like mud rather than shale, and sheetpile cutoff was driven to rock, 50′–90′ below ground surface (see following abstract).—*R. E. Thompson.*

Foundation of Earth Dam Fails. ANON. Eng. News-Rec., 119: 532 (1937). (See preceding abstract). Inspection of Marshall Creek Dam failure confirms that slump was due to failure of foundation material to support weight placed upon it. Beginning on line parallel and close to upstream edge of embankment, downstream part of embankment dropped 40′–50′ and moved downstream nearly 60′, leaving almost vertical face. A few cracks opened up in upstream slope, one being 4″ wide. Dam, which was being built by WPA, consisted of rolled fill of impervious clay compacted in accordance with Proctor method, backed by downstream section of loose rock fill. Bank slopes were normal, 2–1 to 3–1. Puddle trench carried 20′–25′ down to blue clay as cutoff was supplemented by steel sheet-piling driven in cutoff trench to Wea shale, about 25′–30′ below trench bottom. Sheet-piles extended some 10′ up into puddle. Close laboratory supervision of fill construction had been maintained. Investigation is being conducted by a board of survey.—*R. E. Thompson.*

Principal Considerations in the Design of Steel Dams. OTIS E. HOVEY. Can. Engr., 73: 8; 5 and 73: 11; 8 (1937). An extensive discussion of the suitability of steel for the construction of dams. Steel has long been in successful use for movable dams of all types, but for fixed dams its advantages have been overlooked and almost ignored. In many places structural steel is the most economical and desirable material. Probable reasons for absence of more general use is lack of confidence in its durability and fact that a large steel dam was undermined by water. Redridge Dam, in Michigan, a gravity structure of steel and concrete, Skaguay Dam of Southern Colorado Power Co., and Penrose-Rosemont Dam on East Beaver Creek in Colorado, steel-faced rock-fill structures, and El Vado Dam, a gravel- and rock-fill protected on upstream slope by steel plates, are described. These case histories indicate that, with reasonable maintenance, steel dams may be considered to be as permanent as almost any other type of steel construction.—*R. E. Thompson.*

Five Classes of Fill in Large Dam. J. D. JACOBS. Eng. News-Rec., 119: 357 (1937). As low bid of $1,685,231 for earth and rockfill for Inland Dam for new industrial water supply of Birmingham, Alabama, was 8% below lowest bid for concrete, fill type structure was selected. Design is unusual in that 5 classes and sizes of fill, exclusive of riprap, are required, including a million yards of rock of which two-thirds must be mechanically crushed, and 600,000 cu. yds. of compacted earth. Dam, located on Blackburn Fork of Warrior River, 35 miles north of city, will be 1100′ long and 195′ high, creating reservoir of 68,000-acre-foot capacity. Diversion during construction is accomplished through 20′ concrete-lined tunnel. A 22′ circular shaft drops into outlet leg of tunnel from concrete spillway structure on hill adjacent to east flank of dam. The spillway, shaft and tunnel will form overflow outlet from reservoir. Additional safeguard against overtopping is an emergency spillway channel around west end of dam. At inlet, dirt fill above concrete weir acts as fuseplug to be washed out should reservoir level rise to within 10′ of crest of dam. The 60″ steel pipe line to city originates in reinforced concrete intake tower upstream from dam on west side of valley. Pumping plant at dam will provide water when demand exceeds gravity flow from reservoir. Details given regarding construction procedure on tunnel, shaft and dam.—*R. E. Thompson.*

Earth Shocks at Boulder Dam. ANON. Eng. News-Rec., 119: 484 (1937). Revised record shows total of 13 shocks in June, including 2 of intensity II, 8 of intensity III, 2 of intensity IV and 1 of intensity V, modified Mercalli scale. Earthquakes that do not exceed intensity V are not accompanied by earth movements that can be measured. It has been suggested that there are indications that a natural lake existed on site of Lake Mead in comparatively recent geological times and that area may now be readjusting itself to conditions of loading that obtained previously.—*R. E. Thompson.*

FLOODS AND FLOOD CONTROL

Effect of 1936 Flood on Water Purification Plants on Ohio River. Ann. Rept. Ohio Conf. Water Purif., 1936, 75. At Toronto, Ohio, J. B. Thompson reported that water level was 16″–18″ above elevation of operating floor,

necessitating use of bulkheads. Water which leaked through filter decks and into building and pipe gallery was pumped out with the high service unit, which was disconnected from the line for the purpose. Plant was in service again before water in storage reservoir was exhausted. J. S. Scott stated that the quality of raw water at Steubenville was better during the flood than at any other time in year. Water reached depth of 11″ over pumping station floor, just 6″ below motor windings. Station was shut down for over 24 hours, emergency cable being strung on wooden trestles above water level to restore service. Fortunately, reservoir on higher level contained 2 days' supply of water. False radio reports regarding conditions in the city which emanated from other municipalities caused many anxious inquiries. T. R. Lathrop described conditions in Bellaire. Entire station, including pumps for high and low service, settling basins and clear well, were completely submerged and water was over 5′ deep in laboratory. Although motors and alum supply were raised, both were flooded, large amount of latter being dissolved. Storage reservoir, holding 1 mil. gal., was shut off and held in reserve for fire protection. Entire city supply was brought in by tank trucks from neighboring communities. This condition prevailed for several days. When plant was again placed in commission, boiling order was issued until residual chlorine was present in considerable amounts in outlying sections of distribution system. In Marietta, as outlined by H. R. Eggleston, boat-taxi service had to be maintained for distance of more than a mile from dry land to pumping station and filter plant, but station was out of service for only few hours, exhaust pipe of Diesel engine becoming flooded. Plenty of water was available in high service reservoir for use during the period. Great deal of trouble was experienced due to obstruction of strainers in suction line with trash carried by river. It was necessary to resort to well drilled many years before filter plant was built and which had never been used owing to hardness and high iron content. Floc produced by latter rendered unnecessary the use of alum. Use of the well water improved the domestic supply, which had a musty taste up to that time, and well has been kept in service ever since. As a result, neither alum or ammonia is required, operating cost being considerably reduced thereby.—*R. E. Thompson.*

LAND RECLAMATION AND DRAINAGE

Reclaiming California's Central Valley. ANON. Eng. News-Rec., 119: 299 (1937). Within last decade, thousands of acres of fertile lands in San Joaquin Valley have dried up, literally gone back to desert. No remedy is at hand except formidable undertaking of bringing in surplus water from upper reaches of Sacramento River, which is the purpose of the federal government's Central Valley project. Sacramento River, flowing southward, and San Joaquin River, flowing northward, meet in network of channels forming common delta near middle of state, whence there is a common discharge westward into San Francisco Bay through gap in hills. The two basins combined, known as Central Valley of California, include valleyland area roughly 500 miles long by 40–50 miles wide and except for the one gap, area is completely surrounded by mountains. Most of precipitation occurs during winter months, resulting in ample streamflow in spring and early summer but low water later

in crop season. Irrigation soon exhausted surface water supplies and overpumping of ground water sources created serious conditions. From 1927 to 1935 there were only a few years of reasonably good rainfall. Present estimates are that about 50,000 acres of improved land that once produced effectively under irrigation is now going back to desert conditions. Since 1921, more than $1,000,000 has been expended by state in comprehensive studies of all phases of state's water resources, which were followed in 1933 by state legislative action authorizing water conservation and development program, Act providing for enlisting federal aid. Even before then federal interest had begun and in Dec., 1935, the President approved report recommending Central Valley development as federal reclamation project. Scheme, estimated to cost $170,000,000, begins with major storage reservoir in upper reaches of Sacramento River (Kennett Dam) which will provide: (1) flood protection; (2) improved navigation; (3) check to salt water incursion, which has made industrial supplies brackish; (4) storage of previously wasted flood waters for irrigation use; and (5) valuable byproduct in form of power. In addition to Kennett Dam, scheme includes series of pumping plants for lifting Sacramento River water into the San Joaquin via a canalized portion of river and supplementary canal system; Friant Dam for storage in upper reaches of San Joaquin River; and attendant canal system north and south from Friant. Construction will be carried out by Bureau of Reclamation and state will take over operation and maintenance on completion. Funds allocated to present amount to $11,400,000. Terms are that funds advanced shall be reimbursable in accordance with reclamation laws (in 40 years). State officials expect project to be self-liquidating through revenues derived chiefly from sale of water and power. Data on Central Valley and list of references are given. See following abstract.—*R. E. Thompson.*

California's Long-Range Water Plan. ANON. Eng. News-Rec., 119: 344 (1937). Technical details of conditions and proposed works of Central Valley project (cf. preceding abstract) are given. Major engineering features include: (1) Kennett Dam, forming large storage reservoir on upper Sacramento River from which regulated flows will be conveyed down natural river channel as far as the delta: (2) Contra Costa Canal, a channel with pumping plants to carry water from delta into upper San Francisco Bay area; (3) series of pumping plants along San Joaquin to transport Sacramento River water upstream from delta into upper parts of San Joaquin Valley; and (4) operating in conjunction with preceding item, Friant Dam to form supplemental storage reservoir on upper San Joaquin River for supply of canal systems leading therefrom into irrigated areas of South San Joaquin Valley. Water for municipal, industrial and irrigation purposes on south side of Suisun Bay will be diverted from Contra Costa Canal. Extensive investigations had shown that less than 20 per cent of total seasonal runoff of basin as whole is actually consumed: large part of remainder is wasted into ocean. Kennett Dam site, which was considered best of 3 promising locations for key unit of development, was recently approved by Bureau of Reclamation, subject to agreement regarding relocation of 30-mile section of railroad. Expected that plans will be for straight concrete structure of gravity section at least 420′ high above low water to

store 3,000,000 acre-feet as a minimum. About 8 miles downstream, small dam (Keswick Dam) will be built for afterbay regulation, so that irrigation and power production will not interfere with each other. Friant Dam will be gravity concrete structure about 250′ high and of the unusual length of 3380′; reservoir capacity will be 450,000 acre-feet. Utilization of 20,000,000 acre-feet of subterranean storage capacity in Southern San Joaquin Valley by controlled replenishment and extraction in conjunction with surface storage is considered absolutely essential.—*R. E. Thompson.*

STREAM POLLUTION AND CONTROL

Merits of Pollution Bills Reviewed by Wisconsin Committee. ANON. Municipal Sanitation, 8: 414 (1937). Adolph Kanneberg, Chairman of the Wisconsin State Committee on Water Pollution, recently analyzed the merits of these bills. Excerpts listed explain their functions. Pending before the 75th Congress are two bills for the control of water pollution. The Barkley-Vinson bill (S, 702 and H.R., 2711) is entitled "A BILL to create a Division of Water Pollution Control in the United States Public Health Service, and for other purposes." The Lonergan-Pfeifer Bill (S, 13 and H.R. 3419) is entitled "A BILL to prevent the pollution of the navigable waters of the United States, and for other purposes." "In view of the facts thus established at the conference, it would seem that the Barkley-Vinson bill provides for everything that is necessary to be done at the present time and in a way that entails less expense and less governmental red tape than would be incurred under the Lonergan-Pfeifer bill. The Barkley-Vinson bill simply hands over to the department of the federal government most naturally fitted to deal with the subject, the problem of investigating the causes and finding the means of preventing water pollution; and then makes the results of the investigation and research of that body together with the lending power of the federal government, available to the various states and their political subdivisions, and to such private persons who can qualify as proper to receive federal grants in aid of projects for the prevention of water pollution."—*R. E. Noble.*

Separation of Chrome from Chromate-Containing Waste Waters of the Galvanizing Industry. O. WITTMANN AND R. WOHLFAHRT. Chem.-Ztg., 61: 496 (1937). To prevent pollution of public waters, some galvanizing plants make their waste waters alkaline by addition of milk of lime or soda. In waste water containing chromates, latter can be separated by adding sufficient sodium bisulfite to change color of waste water from yellow to green. If waste contains great deal of chromates, color changes first to deep brown and becomes green on further addition of bisulfite. When, with careful agitation, permanent green color is obtained, a little more bisulfite is added, followed immediately by 10% soda solution until water becomes alkaline, whole then being heated to boiling for 3–5 min. On cooling, chrome is precipitated as blue or bluish green sludge, from which it may be recovered.—*R. E. Thompson.*

Industrial Wastes in New Jersey. WILLEM RUDOLFS AND LLOYD R. SETTER. N. J. Agr. Expt. Sta., Bull., 610: 3 (1936). Chemical data on various factory

wastes are tabulated and discussed in relation to problem of stream pollution and disposal.—*R. E. Thompson.*

Sulfite Liquor Disposal. H. K. BENSON. Can. Chem. Met., 21: 306, 310 (1937). Disposal of waste sulfite liquor from the pulp industry is discussed from the standpoints of water pollution and utilization, with particular reference to work that has been carried out in the State of Washington. By the use of sewage methods, utilizing anaerobic reactions, it is possible to destroy by gasification all sugars, together with other minor constituents, but this method is too slow, requiring 2–3 months. *Clostridium fermenticum*, under proper conditions, will convert the sugars into butyric and acetic acids in 2 days. In either method there remains only the lignin as a stable material of faint odor, which, after aeration, does not cause any change in the oxygen consumed: polluting effect is therefore greatly reduced. Use of the waste liquor for dirt road stabilization holds a great deal of promise.—*R. E. Thompson.*

A Flotation Method for Treating White Water. SVEN ANSPACH. Paper Trade J., 104: 9; 40 (1937). Description of the Adka save-all and its application to white-water clarification, together with discussion of its advantages.—*R. E. Thompson.*

The Disposal of Industrial Effluents. H. T. CALVERT. Chem. Eng. Congr. World Power Conf., 1936, Advance proof No. F3, 12 pp. Brief historical summary from inception in 1865 to appointment of scientific advisory and research boards in 1927, and of coöperative legal action taken. Brief outline is given of present status of relation between the boards, the law, the manufacturer and the domestic sewage problem.—*R. E. Thompson.*

Purification of Waste Water from Yeast Factories. K. ERIK JENSEN. Chem. Eng. Congr. World Power Conf., 1936, Advance Proof No. F2, 16 pp. In recent years, purification of waste water from large bakers' yeast plants, usually with molasses as raw material, has become serious problem. Purification has been satisfactorily effected at several Danish and Swedish plants by anaerobic fermentation at temperatures averaging 35°C. After fermentation, water passes through series of sludge-settling ponds where secondary fermentation may also take place. Final purification is effected by passage through biological (trickling) filters. Gases produced are utilized for heating, with consequent fuel saving. Sludge volume is relatively low.—*R. E. Thompson.*

Dephenolizing Phenolic Industrial Waste Liquors. E. GÖSMEIER-KREß. Brennstoff-Chem., 17: 466 (1936). The Pott-Higenstock process of the Emschergeonossenschaft, the Lurgi activated carbon process and the IGF tritolyl phosphate process are discussed, the latter in considerable detail in connection with carbonization and hydrogenation liquor effluents.—*R. E. Thompson.*

The Treatment and Disposal of Industrial Wastes. W. L. STEVENSON. Chem. Eng. Congr. World Power Conf., 1936, Advance Proof No. F7, 24 pp.

A general discussion of waste disposal is followed by brief summaries by authorities on present practice on acid mine drainage, by-product coke-oven waste water and wastes from corn products, cotton textiles, dairy industry, gas works, grain distilleries, leather tanning, petroleum refining, pulp mills, vegetable canning and wool scouring.—*R. E. Thompson.*

Effluent Problems in the Pulp and Paper Industry. W. STEFFENS. Papier-Fabr., **34**: 140, 145 (1936). Recovery of various waste liquors and particularly commercial utilization of sulfite-waste liquor is discussed. Disposal of sulfite mill effluent (E) by seepage is dangerous, but Nolte's method of decomposing it biologically in presence of phosphorus and nitrogen has been largely successful in reducing its oxygen absorption. Its presence in small quantities, however, is not harmful to river life since it absorbs oxygen under those conditions extremely slowly. Plea is made that potassium permanganate reaction should not be used to indicate polluting power of effluents. It leads to false conclusions because biochemical oxidation occurring in rivers is much milder than permanganate reaction and permanganate consumption by different organic substances is extremely variable. Biochemical oxygen demand of domestic sewage, for example, may be 12 times as great as that of E with same permanganate consumption. Tables also show that rate of oxidation of E is much slower than that of sewage. Various methods of recovering suspended matter are reviewed, including use of Adka save-all, operation of which in practice confirms results of recent investigations (see following abstract). With waste boards and brown mechanical pulp as raw materials, recovery of 96–99% of solids was obtained without addition of reagents.—*R. E. Thompson.*

Detection and Measurement of Stream Pollution. M. M. ELLIS. U. S. Bur. Fisheries, Bull., **22**: 365 (1937). Natural inherent water conditions of most streams can be ascertained satisfactorily for pollution studies as regards fishery problems by determining repeatedly at different times of night and day, and at various seasons of year, the dissolved oxygen, pH, ionizable salts, fixed and free carbon dioxide, total ammonia and suspensoids. Values for these determinations fall within rather definite limits in waters suitable for good fish growth. Minimum values for dissolved oxygen are approximately 5 p.p.m. Extreme range of pH found in United States inland waters containing fish was 3.9–9.5. General range of fish-bearing streams on lowlands was 6.3–8.6, while mountain streams were more acid. Specific conductance offers ready method for detection of salt and acid pollution, as produced by water from oil wells, mines, by wastes from various industries and by soluble salts of heavy metals. If specific conductance exceeded 1,000 mhos in streams, except those in more alkaline regions, pollution was indicated. In alkaline waters, critical value for specific conductance indicating waste pollution was 2,000 mhos. Values for free carbon dioxide in excess of 3 cc. per liter was indicative of pollution in inland streams. Iron in quantities above 100 p.p.m. was associated with superacidity and often chemical or mine pollution was found. Iron as it occurs in streams is not a major limiting factor for fishes: 100 p.p.m. of iron was not harmful to fish or daphnia. Approximately 1.5 p.p.m. dissolved ammonia in fresh waters was considered the maximum amount

not suggestive of specific organic pollution. Some acclimatization to ammonia is possible, and it is well known that individuals of various species of fish may be found in waters containing from 3–10 p.p.m. of ammonia. In flowing streams, 2–3 p.p.m. was nearly always associated with definite organic pollution and values above 3 were always traceable to sewage or factory effluents. Suspensoids consist mainly of erosion silt, organic detritus, bacteria and plankton. Silt causes turbidity and prevents light from penetrating far into water. It also takes down organic wastes and thus increases oxygen demand at bottom of stream. In unpolluted favorable fish streams carrying little erosion material, the millionth intensity depth, i.e., level at which light entering surface of stream would be reduced to one-millionth of its surface intensity, is 50 meters or more. It is suggested that silt load of streams favorable for fish growth should be reduced so that millionth intensity level would not be less than 5 meters. 66% of inland streams of United States have summer water temperatures between 22 and 30°C. Mountain and headwater streams are between 10 and 15° in summer. Flora and fauna of polluted and natural streams are discussed. Lethality tests with fish and plankton organisms for approximately 113 chemical substances or pollutants are described. Results were obtained by adding the chemical in definite concentrations to water containing test fish under prescribed conditions. Some of the data are taken from the literature. Toxic limits of these substances are given. The specific effect of 30 types of industrial wastes on fish and on physical and chemical composition of water is given. Bibliography.—*R. E. Thompson.*

Stream Pollution Checked by Cooperative Program. ANON. The American City, **52**: 9; 101 (1937). The sulphuric acid pollution of the streams in the Ohio River Basin has been reduced through the sealing of abandoned coal mines. Working with the Works Progress Administration units are the health and conservation departments of the states of Ohio, West Virginia, Pennsylvania and Kentucky, the U. S. Public Health Service, the Bureau of Mines and the Corps of Engineers. By sealing mines against the entry of air and permitting the water to escape, acid-pollution has been reduced in some streams so that fish life has returned, water supply sources and riparian values have increased and the deterioration of steel river structures has decreased.—*Arthur P. Miller.*

WATER QUALITY

Water Supplies and the Public Health. J. SMITH. The Surveyor, **91**: 520 (1937). From a public health viewpoint there is every reason to demand that a full knowledge of the qualities of a proposed water supply should be obtained before it be utilized for drinking purposes. The water scarcity of the past two years has had the beneficial effect of indicating the necessity for a survey of the available water supplies. In the bacteriological control of a polluted water supply samples of water should be collected from the source before treatment and the results compared with those of samples taken after treatment. A tendency has been manifest to advocate chlorination as against filtration. Studies made by the public health services in the United States indicate quite clearly that the average surface water cannot be effectively chlorinated in the

absence of filtration unless the average number of bacteria of the coli group is less than 450 per cc.—*H. E. Babbitt.*

Seasonal Fluctuation of Lake Bacteria in Relation to Plankton Production. A. T. HENRICI. J. Bact., 34: 137 (1937). An abstract. "Total net plankton, bacteria per cc. of water by plate counts, and bacteria per sq. m.m. per day deposited on glass slides, were determined at weekly intervals throughout the period from melting to freezing of the lake, in a seepage lake during a drought year. There was no appreciable contamination of the lake with material washed in from the surrounding land. Under these conditions, the curves for bacteria by both methods followed very closely curves for total plankton, lagging behind about one week. It is concluded, therefore, that the amount of organic matter produced by plankton determines growth of bacteria in lake water."—*Ralph E. Noble.*

Further Studies on the Minimal Threshold of Chronic Endemic Dental Fluorosis. H. TRENDLEY DEAN AND ELIAS ELVOVE. Public Health Reports, 52: 37; 1249 (1937). The "approximate" mottled enamel index in Clovis, N. M., is "slight"; that of Webster City, Iowa, and East Moline, Ill., "border line"; while that of Junction City, Kans., is "negative." The "actual" mottled enamel indices of East Moline and Junction City are the same as the "approximate," while the "actual" index of Webster City approaches so close to the next higher classification that it is listed as "border line—slight." The mean annual fluoride (F) content based upon monthly examinations of the common water supply received between Dec. 1935, and Nov. 1936, was: Clovis, about 2.2 p.p.m.; Webster City, 1.6; East Moline, 1.5, subject to corrections which might somewhat reduce these values. Problems of sampling are discussed and illustrated with examples from surveys of cities whose common water supplies show different fluoride concentrations. The quantitative value of the "seven-grade" classification of mottled enamel diagnosis is shown. Additional evidence suggests that amounts of F not exceeding 1 p.p.m. are of no public health significance.—*R. E. Noble.*

Changes in Standards of Purity for Drinking Water—1880–1935. A. M. BUSWELL. Bull. Assoc. State Eng. Soc., 11: 2; 31 (1936). Review of progress in chemical and bacteriological standards. Twenty-four references.—*R. E. Thompson.*

TREATMENT—GENERAL

Fluoride in Ohio Water Supplies: Occurrence and Removal. R. D. SCOTT, L. F. EY, F. H. WARING. Ann. Rept. Ohio Conf. Water Purif., 1936, 26. Examinations made to date have shown that there are 49 water supplies (mostly municipal) in Ohio which contain more than 1.0 p.p.m. of fluorine, 17 of these containing more than 2.0 and three 3.0 p.p.m. or more. Observations in practice having shown that the fluorine content is reduced by lime softening, a laboratory investigation, which is described, indicated that there is a definite relationship between magnesium removal and fluorine removal which may be expressed, approximately, for initial concentrations of 1.5-3.5 p.p.m.,

as: $F = 0.07F_1 \times Mg^{0.5}$, where F is fluorine removal, F_1 initial fluorine concentration and Mg the magnesium removal. On this basis, 23 and 146 p.p.m. of magnesium, respectively, would have to be removed to reduce fluorine from 1.5 and 3.5 to 1.0 p.p.m. The fluorine is probably adsorbed by the gelatinous magnesium hydroxide. To effect a high magnesium removal, it is necessary to add sufficient lime to raise pH to about 10.5, i.e., caustic alkalinity of 30 p.p.m. or more and if natural magnesium content of water was insufficient for desired magnesium removal it would have to be increased by addition of, e.g., magnesium sulfate. Experiments on removal by alum treatment indicated that 11.5, 20 and 52 g.p.g., respectively, would be required to reduce fluorine concentrations of 1.7, 3.0 and 6.0 p.p.m. to 1.0 p.p.m. The Sanchis method of determining fluorine, with slight modifications, applying correction for sulfate contents of 250 p.p.m. or higher, was employed. Seventeen references. Discussion. A. Elliott Kimberly. Ibid. p. 30. Water of high fluorine content is usually found in limestone, but occasionally also in sand and gravel, when associated with shale. In general, for Ohio waters, the magnesium content may be assumed to be 9% of the total hardness. A graph is given, based on the formula given above, from which may be read the magnesium removal required for various fluorine contents and reductions, and calculations are made of the chemical cost of such treatment. A well should not be considered as a source of public water supply without definite information regarding the fluorine content of the water. L. L. Hedgepeth suggested that treatment of crushed dolomitic limestone with sulfuric acid would provide a relatively inexpensive source of magnesium.—*R. E. Thompson.*

Filtered Water for Covington. J. STEPHEN WATKINS. Eng. News-Rec., 119: 466 (1937). The 20 m.g.d. softening and purification plant approaching completion at Covington, Ky., is described in detail. Formerly, Ohio River water was used after coagulation with lime and alum and sedimentation. Two of the old basins, holding about 35 mil. gal. each and providing 4–7 days' detention, will be used for primary sedimentation, which will equalize the quality of the river water, particularly with respect to the widely varying turbidity. The filter plant is being constructed over the third basin, utilizing a portion of the basin for a clear well. Pneumatic conveyors are provided for unloading chemicals. Alum will be used as the coagulant, with lime for pH adjustment, and when the hardness is above the usual value of 100 p.p.m., excess lime and soda ash softening, with recarbonation, will be employed to reduce it to that figure. Activated carbon will be used to control tastes and odors and provision is made for pre- and post-ammonia-chlorine treatment. A quick-mix basin has been provided and the coagulation basins are equipped with paddles revolving on horizontal axis. The sedimentation basins will be equipped with rotary sludge-scraping mechanisms for continuous sludge removal. The detention period in the coagulations basins will be 68 minutes and in the settling basins 2 hours and 27 minutes, velocity of flow in both being 0.66 ft. per min. All basins are 15′ in depth. To ensure even flow throughout entire width, inlet flume of varying cross-section has been provided across end of each coagulation basin, with adjustable steel-plate weirs. Filters are of standard design, with cast iron laterals, 18″ of gravel and 27″ of

sand. Latter has effective size of 0.38–0.45 mm. and uniformity coefficient of 1.65. In addition to bottom wash (32″ rise per minute), filters are equipped for surface washing through perforated cast iron pipes, 2″ above sand level, designed for wash equivalent to 12″ rise. Filtered water storage totals 8 mil. gal., i.e., clear well at plant of 4 mil. gal. capacity, and 2 equalizing reservoirs of 1 and 3 mil. gal. capacity in city. Pipe lines are provided to laboratory from which can be drawn samples of raw, settled and finished water. Project, costing $810,000, was financed with aid of PWA, which provided 45% grant. Population served, which includes adjoining communities, is about 95,000.—*R. E. Thompson.*

Swimming Pools and Bathing Facilities. G. A. H. Burn. Can. Engr., 73: 10; 13 (1937). A general discussion. There has been marked trend in design of swimming pools in recent years toward providing more rapid turnover rates, 8-hour rate being frequently employed. In England, 4-hour rate is not uncommon. Filters most commonly used are pressure mechanical type, filtration rates being frequently as high as 3 gal. per sq. ft. per min. Use of alum necessitates employment of alkaline compound, usually soda ash, to maintain alkalinity of water. Pool water should at all times be alkaline to methyl red. If pH method is used, value should be maintained between 7.5 and 8.0. Usual standard for chlorine sterilization is maintenance of residual chlorine in pool of not less than 0.2 or more than 0.5 p.p.m. An 0.3–0.6% solution of available chlorine is suggested for preventing spread of foot infections. Adequate sanitary conveniences and showers should of course be provided and upward flow spray beneath each shower is desirable. In regard to wading pools, provision should be made for frequent draining and cleaning and for sterilizing the water. In determining suitability of natural waters and semi-artificial pools for bathing, 3 aids are available: (1) Sanitary survey. (2) Bacteriological examination of water. (3) Chemical analysis of water. Health hazard of small amount of sewage pollution in close proximity to bathing area is far greater than much larger amount at considerable distance. Generally speaking, application of chemical disinfectant to waters of natural bathing places is not feasible, although in some instances some success has been attained by use of "chloro-boat" and disinfection by means of extensive piping systems along bottom. It would appear at present time that emphasis should be placed on reduction of pollution rather than on disinfection. Definite standards of bacterial quality for waters of natural bathing places is a difficult problem and wisdom of adopting such standards is open to question. Consensus of opinion is that there is great lack of epidemiological information regarding sickness caused by bathing in polluted water.—*R. E. Thompson.*

Review of Water Purification and Water Softening Literature for 1936. Clarence Bahlman. Ann. Rept. Ohio Conf. Water Purif., 1936, 16. Chief subjects dealt with are the effect of air conditioning on water supply, thawing of services, addition of sodium chloride to drinking water to prevent heat fatalities, goldfish mortality, filtration, use of marble test for adjusting chemical equilibrium of water, and standard methods of water analysis.—*R. E. Thompson.*

Ten Years in Water Purification at Windsor, Ontario. G. HUDSON STRICKLAND. Ann. Rept. Ohio Conf. Water Purif., 1936, 42. Since the plant was placed in commission in 1926, the annual averages have varied as follows: turbidity, 24–59 p.p.m.; consumption, 81–105 gal. per cap. per day; length of filter run, 13–36.75 hours; wash water, 2.6–5.3%; *B. coli* content of raw and filtered water, expressed as most probable number per 100 cc., 39.71–77.98 and 0.14–1.74, respectively. The length of filter run has been consistently increased, the wash water reduced and quality of filtered water improved. Prechlorination has contributed materially to this record. Chlorine dosage ranged from 1.5 to 2.5 lbs. per mil. gal., the filter effluent containing 0.04 p.p.m. residual chlorine. Ammonium sulfate is also employed, ratio of ammonia to chlorine being 1–4. Latter treatment has effectively eliminated chlorophenolic tastes.—*R. E. Thompson.*

How the Extreme Cold Weather of 1935–6 Affected the Operation of Water Purification Plants. ANON. Ann. Rept. Ohio Conference Water Purif., 1936, 72. Experiences in 8 communities with freezing of wash water tank risers, altitude valves on standpipes and pressure lines to Venturi meters and formation of ice layers on settling basins and clarifiers are outlined. At Fremont, it was found that ice in the basins could be cut much faster with a steam jet, at 100 pounds pressure, than with a saw. Tank risers were thawed out by surrounding them with housing heated with oil stoves or salamanders.—*R. E. Thompson.*

Fluorine at Topeka Reduced by Treatment. ANON. Eng. News-Rec., 119: 472 (1937). According to D. W. Rupp, water softening at Topeka consistently removes more than one-third of fluorine found in raw water. Maximum fluorine content of untreated water since 1935 has been 1.2 p.p.m. and minimum 0.07. Average concentrations in raw and treated water in 1935, 1936 and 1937 (4 months) were: 0.48 and 0.36, 0.72 and 0.40, and 0.95 and 0.55 p.p.m., respectively. Up to 2 p.p.m. is generally not considered troublesome.—*R. E. Thompson.*

Simple Water Purification for Camps. FRANK B. KING. Eng. News-Rec., 119: 525 (1937). An adaptation of the canvas-tank purification plant for troops in the field is used for CCC camps on forest roads in Oklahoma, concrete tanks being substituted for canvas units. Water is pumped into two-compartment tank where alum and lime are stirred in with a wooden paddle and after sedimentation water is treated in second tank with chlorine and then pumped to elevated tank.—*R. E. Thompson.*

Transite Pipe Installations. ANON. Ann. Rept. Ohio Conf. Water Purification, 1936, 81. Use of this type of pipe for various purposes was reported upon briefly, e.g., in filter underdrainage systems, to replace cast iron pipe laid in cinders where life of latter was only about 5 years, in the carbon dioxide grid system of recarbonation plants, and as wash water troughs (section being cut out) in upward flow zeolite softeners where steel troughs corroded badly.—*R. E. Thompson.*

FILTRATION

New Type of Control for Filter Plant Operation. DAVID BROWNLIE. Eng. Cont. Rec., 50: 81; 9 (1937). Illustrated description of the new Paterson filter operating table, which is provided with hydraulic switches of advanced design and series of small finger-tip control levers. Switches consist of 4 rubber-seated disc valves. Advantages compared with 4-way plug valves include absence of leakage, ease with which opening and closing speed may be varied and elimination of frequent regrinding which is necessary with all plug cocks.—*R. E. Thompson.*

Details of Pressure Water Filter Plants in Canada. ANON. Eng. Cont. Rec., 50: 81; 15 (1937). Data, compiled for Waterworks Information Exchange of Canadian Section, A. W. W. A., are given showing source of supply and its quality, population served, size of units, date of installation, etc. Tabulation is arranged alphabetically by provinces.—*R. E. Thompson.*

The New Water Filtration Plant of Hammond. LEO BESOZZI. W. Wks. and Sew., 84: 193 (1937). Extreme pollution of Lake Michigan water at Hammond, Ind., necessitated filtration. Prior to complete treatment, chlorine doses of 7 p.p.m. were sometimes required. Plant rated capacity is 20 m.g.d. Included in plant are: raw water well, low and high lift pumps, vertical mechanical mixing basins of 30 minutes retention, four hour sedimentation basin, filters, clear water storage, and equipment for feeding alum, copperas, lime, activated carbon, ammonia and chlorine. Details are given on various units and equipment used. Costs of construction are stated.—*H. E. Hudson, Jr.*

Experiments with Jewell Sub-Surface Filter at Toledo, Ohio. R. W. FURMAN. Ann. Rept. Ohio Conf. Water Purif., 1936, 63. The Toledo filter plant, which consists of 56 one m.g.d. rapid sand units, has been heavily overloaded since 1930, filters being operated at rates up to 30% in excess of rated capacity and the inadequacy of the settling basins imposing an additional burden. Effective size of filter sand has increased by incrustation from 0.38 to 0.58 mm. An average analysis of the incrusted material, expressed as percentage, is as follows: total incrustant, 34.54; insoluble, 12.79; alumina + ferric oxide, 36.73; magnesium oxide, 1.23; calcium oxide, 1.99. In Dec., 1935, depth of sand in one unit was increased from 24″ to 34″ and filter was equipped with Jewell sub-surface filtering and washing units, which permit application of portion of influent and introduction of wash water at a number of points located 8″ below sand surface, thus increasing rate of filtration without increasing rate of flow through surface sand. Results obtained during period of 8 months, filter being operated at rates varying from 0.75 to 1.7 m.g.d., are discussed. The incrustation on the sand grains was very considerably reduced, except in top 8″ of filter, and bacterial reduction compared satisfactorily with other units up to May 17, after which tendency for higher bacterial counts was more pronounced in experimental unit. There was evidence that sub-surface washing had tendency to disintegrate algae. This has been corrected it is believed, although not confirmed, by preceding the combined wash with up-

ward-flow wash only for 2 minutes. It is planned to reconstruct the settling basins and install flocculators. The tests with the sub-surface units will then be continued. The cost of equipping a filter is about $4,000.—*R. E. Thompson.*

The Magnetite Filter in Sewage and Water Treatment. S. I. ZACK. W. Wks. and Sew., 84: 201 (1937). Following a brief description of the magnetite filters, their development and various installations are described. Both upward and downward flows are used. Operation results in various sewage treatment plants are given, especially data from tests at Coney Island. Tests on water from Lake Sebago, Me., are described. These indicate about two-thirds removal of micro-organisms and amorphous matter. Cost of units is estimated at $5,000 per m.g.d. capacity, or $1.50 per m.g. Rates of filtration, possible uses, grain sizes, and advantages of use are mentioned.—*H. E. Hudson, Jr.*

Pressure Filters in Canada. ANON. Can. Engr., 73: 3; 10 and 73: 4; 12 (1937). Eng. Cont. Rec., 50: 89; 15 and 50: 93; 13 (1937). Data compiled for Water Works Information Exchange of the Canadian Section, American Water Works Association, are given. Tabulations include coagulation details, e.g., chemicals used, feed equipment, average dosages and cost of chemicals, and particulars regarding construction, e.g., depth and size of sand and gravel, rate controllers, cost of filters, etc.—*R. E. Thompson.*

TASTE AND ODOR CONTROL

Causes of Tastes and Odors. ANON. Public Works 68: 9; 14 (1937). Results of survey of taste and odor problem in 750 cities. Only approx. 10% admit having tastes and odors in supply and most of these only in raw water. Predominant causes of tastes and odors in various states is given, tabulation being divided into trade wastes (10), algae (96), leaves (36), decaying vegetation (50) and other causes (17).—*Martin E. Flentje.*

Practical Carbon Testing. B. G. YAXLEY. W. Wks. and Sew. 84: 350 (1937). Plant comparison of activated carbons was arranged by splitting plant into two parallel units and feeding equal carbon doses through each half. Dose of "Standard" carbon was such as to leave slight residual odor. Results conclusively demonstrated superiority of one particular carbon.—*H. E. Hudson, Jr.*

The Removal of Odors, Tastes and Iron from Water. W. E. GALLIGAN. Bull. Assoc. State Eng. Soc., 10: 4; 53–62 (1935). Causes of odors and tastes in water and their removal by various aeration processes are discussed. Summary of report by Flentje, *et al.* on other methods of odor and taste removal is included. Current practice in iron removal is reviewed also. Sixteen references.—*R. E. Thompson.*

Experiences with Application of Activated Carbon in Reservoirs. E. A. SIGWORTH. Eng. Cont. Rec., 50: 93; 10 (1937). Experiences at Bath, Eng-

land, where application of activated carbon to reservoir for taste and odor removal was first experimented with, and at Belmont Lake, Wash. and Tyrone, Pa., Kittery Junction, Me., and New Haven, Conn., are described. Settling of carbon in reservoirs is much more rapid than is indicated by experiments in laboratory in small glass containers: 10–12 hours has been found sufficient in some instances. The carbon should be thoroughly wetted by mixing to a thin slurry with water and then distributed over surface of reservoir in proportion to depth either by spraying or by using the propeller of a motor boat to effect diffusion. A dosage of 2 p.p.m. is usually sufficient. Prior treatment with copper sulfate or lime increases the rate of settling. At New Haven, the water in a 15-mil. gal. reservoir developed a greenish hue, the total color reaching an intensity of 40 p.p.m. Copper sulfate, 0.5 p.p.m., was added in the morning and carbon, 1.5 p.p.m., in the afternoon and the water used next morning. The green color was completely removed and total color reduced to 10 p.p.m. A content of 8 p.p.m. of carbon is barely perceptible in a glass of water.—*R. E. Thompson.*

Development of Treatments for Eliminating Taste and Odor in Water. John R. Baylis. Bull. Assoc. State Eng. Soc., 11: 2; 23 (1936). A review. Advantages and disadvantages of following processes are discussed: charcoal, aeration, chlorination, superchlorination followed by dechlorination, activated carbon, ozone, potassium permanganate and bleaching clays. Forty references.—*R. E. Thompson.*

Effect of Applying Pulverized Carbon Previous to Filtration. C. P. Hoover. Ann. Rept. Ohio Conf. Water Purif., 1936, 78. In Feb., 1935, for first time since 1912, tastes and odors developed in the Columbus, O., water supply, lasting for about 28 days. Threshold value varied between 40 and 330. Laboratory tests indicated: (1) That 300 lbs. per mil. gal. was minimum effective dose of activated carbon. (2) That reduction of tastes and odors is not directly proportional to amount of carbon used. (3) That odors or tastes with threshold value of 10–20 are not especially objectionable, tastes and odors of 10 or less being difficult to detect in laboratory. Carbon was added at rate of 100 lbs. per mil. gal. to settled water just ahead of filters and within 24 hours the carbon passed through the heavily incrusted sand, increasing the chlorine demand to 2 p.p.m. and resulting in positive fermentation tests. Point of applying carbon was changed to raw water, ensuring removal before reaching filters, and recarbonation was discontinued temporarily, the resulting causticity rendering the effluent bacteriologically safe. Discussion. Richard N. Statham. Ibid. p. 79. In general, laboratory tests indicate higher dosages than are usually required in practice. A dosage of 300 lbs. of carbon per mil. gal. for 1 month would increase the water bill in Columbus only 0.1¢ per 1,000 gal., or 4¢ per capita per year. Reduction of tastes and odors is usually logarithmically proportional to carbon dosage. Consensus of opinion is that odor or taste with threshold value of 3 will cause consumers' complaints.—*R. E. Thompson.*

Evaluation of Activated Carbon for Water Treatment. Henry Laughlin. Taste and Odor Control, 3: 5; (1937). Detailed procedures are given for

threshold, phenol, dispersion, suspendability and screen tests, apparent density and moisture determinations.—*R. E. Thompson.*

SOFTENING AND IRON REMOVAL

Effect of Various Types of Water on Plant Growth. C. P. HOOVER. Ann. Rept. Ohio Conf. Water Purif., 1936, 80. To determine whether the use of softened water was injurious to greenhouse plants, Feverfews, Calendulas and Snapdragons were grown in acid, neutral and alkaline soils and watered regularly with Columbus lime-soda softened tap water with pH value of about 9.2, distilled water and water containing 100, 200, 300 and 400 p.p.m. of sodium carbonate, the latter corresponding to various grades of zeolite-softened water. The pH value of the soil in each pot was determined every 2 weeks for period of 6 months. Results indicated that the various waters had no detectable effect on either the soil reaction or the development of the plants.—*R. E. Thompson.*

Advantages and Disadvantages of Various Iron Removal Devices. THOMAS R. LATHROP. Ann. Rept. Ohio Conf. Water Purif., 1936, 67. Iron removal plants recently installed in 7 Ohio communities outlined and their operation commented upon. Systems involved include coke tray aeration, settling and filtering; "Aeromix" aeration and filtration; lime treatment in pressure chamber over pressure filter; aeration with compressed air in pressure compartment above pressure filter; combined softening and iron removal in zeolite units; and greensand, regenerated with potassium permanganate, for iron removal only. Several of the plants were designed to eliminate double pumping; author believes that plain aeration and sand filtration with double pumping would have been more satisfactory and economical in the small communities. In several instances, corrosiveness of water produced nullified iron removal effected, the water acquiring as much if not more iron in passing through distribution system than was originally present in raw water.—*R. E. Thompson.*

Water Treatment in Steel Tanks. MALCOLM PIRNIE. Eng. News-Rec., 119: 461 (1937). The water supply of the Pinellas Water Co., serving St. Petersburg, Fla., is derived from 12 wells installed in 1930, the water, after spray aeration at the top of a steel tank, being delivered, via a 36″ concrete pipe line, 22.5 miles to city. Softening being decided upon in 1935, the hydraulic conditions required construction of tanks which would hold the water at a flowline slightly over 20′ above ground. Laboratory experiments indicated that the desired purification could be effected by softening 60% of the aerated water with lime and treating remainder with sufficient ferric sulfate to coagulate the mixture of softened and unsoftened water, the carbon dioxide retained in the latter plus that liberated by the ferric sulfate being sufficient to recarbonate the softened portion. Mixing is effected by a modified inductor-type mixer, utilizing energy in bypassed water. Flow in softening and coagulation tanks is upward through the precipitated materials, which apparently aids in the completion of the chemical reactions. The ferric sulfate feed apparatus consists of rubber-lined tanks and glass eductor. The dosage used is 0.6 g.p.g. Rate of filtration is guided from storage tank in city, over 22 miles away. Rate is approximately 2.5 gal. per sq. ft. per min.

when plant is operated at 6.66 m.g.d. Underdrains are of perforated transite pipe. During a 6-month period of operation, average methyl orange alkalinity and soap hardness of raw and treated water, respectively, were 183:180 and 90:99 p.p.m. Average pH of filtered water was 7.9, color never exceeded 5 p.p.m. and iron only a trace. The cost of the plant was $134,000.—*R. E. Thompson.*

Soft Water and Its Significance for Water Supply. L. W. Haase. Chem. Fabrik, 1937, 249. German water resources are reviewed and attempt made to classify consumption according to uses, especially in regard to soap consumption and recovery of fats and oils. Some of conclusions are: practically all supplies of soft natural water are now utilized; very small fraction of total is used in connection with soap and fats; only about 3% of the plants can supply softened water economically; small softening equipment for individual houses is not feasible; soap economy is possible through training consumer in coöperation with manufacturer of softening compounds and legal regulation of price of such compounds.—*R. E. Thompson.*

LABORATORY METHODS

Optical Spectroscopic Determination of Boron. R. K. Caffee and J. S. McHargue. Ind. Eng. Chem., Anal. Ed., 9: 288 (1937). Boron is converted to methyl borate, volatilized with methyl alcohol, burned in oxygen before absorption cell containing standard potassium permanganate, and estimated from volume of permanganate required to obscure bright lines of boron spectrum. Brines and other waters are made alkaline before concentrating for test. Method has been applied to samples of various substances containing 1 to 600 p.p.m. of boron.—*Selma Gottlieb.*

Errors of the Glass Electrode. William C. Gardiner and Herbert L. Sanders. Ind. Eng. Chem., Anal. Ed., 9: 274 (1937). At temperatures above 30°C., two types of glass electrodes studied did not agree with hydrogen electrode in alkaline, neutral or acid ranges. The deviations, though greatly affected by temperature changes and sodium ion concentration, are entirely reproducible and correction curves are given for glass electrodes studied. Theory of these errors is discussed.—*Selma Gottlieb.*

Low Resistance Glass Electrodes. H. Mouquin and R. L. Garman. Ind. Eng. Chem., Anal. Ed., 9: 287 (1937). Using special low resistance glass tubing, a relatively rugged glass electrode is made by producing thin glass membrane at contact surface between two stemmed glass bulbs, to contain respectively reference and unknown solutions. Bulb for unknown solution is pierced for drainage.—*Selma Gottlieb.*

Preservation of Standard Sulfuric Acid. Norris W. Matthews. Chemist Analyst, 26: 62 (1937). To prevent formation of mold in N/50 sulfuric acid, add 4 drops of 37% formaldehyde to each 3 liters of solution.—*R. E. Thompson.*

Colorimetric Determination of Aluminum in Water. G. Gad and K. Naumann. Gas-u. Wasserfache. 80: 58 (1937). Generally two methods for the

determination of aluminum are in use, one using hematoxylin and the other using alizarinsulfoacid. In both methods iron interferes if present in more than 0.2 p.p.m. The authors worked out methods to avoid this interference of iron and give full description of reagents and procedure. In the method using hematoxylin potassium cyanide is used to eliminate the influence of the iron, and in the method using alizarinsulfoacid sodium thiosulfate serves for this purpose.—*Max Suter.*

Determination of Carbonate Hardness. JOSEF BITSKEI. Zeitschrift für analytische Chemie, Vol. 108: 1/2, 18 (1937). Results of standard titration of alkalinity with methyl orange are said to be influenced by carbon dioxide; for greater precision it is proposed to remove carbon dioxide by evaporation with boric acid and to titrate residual borate with methyl red. Following procedure is recommended: In order to evaluate suitable dose of boric acid methyl orange alkalinity according standard procedure in a preliminary test is determined. Add 1 g. of sodium chloride and for each ml. N/10 hydrochloric acid 0,2 g. boric acid to 100 ml. of the sample in a white porcelain casserole, evaporate on a water bath, dissolve the residue with 80–100 ml. distilled hot water and titrate with N/10 hydrochloric acid and 4 drops methyl red.—*Manz.*

Testing Base-Exchange Materials for Activity and Stability. HEINRICH RIEMER. Mitt. tech. Versuchsamtes, 25: 49 (1936). Method for determining base-exchange coefficient is: 100 grams of material is introduced into glass filter of such diameter that height of bed is 10 cm. Charge rests on layer of glass beads, and is covered by second layer. Material of unit base-exchange coefficient is one which removes 1 gram CaO from calcium sulfate solution of 30° German hardness without residual hardness of effluent exceeding 0.5° German at 5, 10 and 15 meters per hour flow rate. Comparison of actual amount removed with the standard gives base-exchange coefficient. For regeneration, theoretically, removal of 10 mg. of CaO requires 21 mg. of NaCl; this ratio is never actually attained. Determination of salt-demand consists of comparing amounts of NaCl required to remove equivalent amounts of contained calcium from comparison samples previously saturated with calcium sulfate. Degradation loss involves (a) attrition losses and (b) decrease in regenerative efficiency with use. Sample is treated first with distilled water, then with several types of water encountered in practice containing known silicic acid contents. Increase in concentration of silica and sodium salts in effluents is determined gravimetrically and losses due to (1) mechanical attrition and (2) exhaustion of regenerative ability are calculated on percentage basis. Comparative data for a natural and two artificial zeolites are presented.—*R. E. Thompson.*

A Volumetric Method for Rapid Determination of Iodine in Mineral Water. H. IVEKOVIĆ AND L. DANČEVIĆ. Arhiv. Hem. Farm., 10: 51 (1936). Sample is treated with sodium carbonate, partly evaporated, filtered, acidified with HCl and iodine precipitated with potassium nitrite; mixture is made alkaline with sodium bicarbonate and iodine dissolved as sodium iodide by treating with sodium arsenite. Solution is then titrated with 0.02 N iodine solution

and difference between iodine consumption of this solution and blank sample gives iodine content of water.—*R. E. Thompson.*

Determination of the Carbonate Hardness of Water. JOSEF BITSKEI. Z. anal. Chem., 108: 18 (1937). Method titrating to methyl orange or methyl red end point does not always give satisfactory results, particularly with waters of moderate hardness. It is best to remove carbonate by evaporation with boric acid. First determine bicarbonate content by titrating with 0.1 *N* HCl to methyl orange end point. Then, for every 5 cc. of acid or fraction thereof required, add 0.2 gram of boric acid to 100 cc. of the water. Add also 1 gram of NaCl and evaporate to dryness on water bath. Take up residue in 80–100 cc. hot water, add 4 drops of methyl red indicator solution and titrate with 0.1 *N* HCl while stirring constantly. To standardize the HCl, weigh out 1 gram pure potas. bicarb. into 100-cc. volumetric flask, make up to mark with distilled water, mix and take 10–20 cc. for standardization. Add proper quantity of boric acid and continue as in analysis of water. Triplicate analyses of several samples of spring water with hardness of 8–21 German degrees show excellent agreement.—*R. E. Thompson.*

Improvement in the Method for the Determination of Aluminum in the Presence of Iron. SABURÔ ISHIMARU. Science Repts. Tôhuku Imp. Univ. 1st. Ser., 25: 780 (1936). Study of various methods of determining aluminum in presence of iron has led to combination of method of Chancel with that of Hess and Campbell. To the acid solution add ammonium hydroxide until slight permanent precipitate is obtained. Clear the solution by adding about 10 cc. *N* HCl and dilute with water to 300–400 cc. Add large excess of sodium thiosulfate (about 15 grams) and boil the stirred solution for about 5 min. Cool to room temperature and add sufficient 50% phenylenediamine solution in 95% alcohol to cause complete precipitation of aluminum hydroxide. Filter, ignite and weigh as aluminum oxide.—*R. E. Thompson.*

Colorimetric Determination of Nitrates. G. V. L. N. MURTY AND G. GOPALARAO. Z. anorg. allgem. Chem., 231: 298 (1937). α-Naphtholsulfonic acid reacts with small quantities of nitrate forming a compound of a strong yellow color (probably naphthal yellow) when solution is made alkaline. Reagent is easily prepared by heating 20 grams of α-naphthol with 200 cc. concentrated sulfuric acid on water bath. It can replace phenolsulfonic acid to advantage in colorimetric determination of nitrogen as nitrate. To prepare standards, take 25 cc. of solution containing 0.01 mg. of nitrate nitrogen per cc., evaporate to dryness and add 2 cc. of reagent. After 15 min., dilute the solution, add 8 cc. of 10 *N* sodium hydroxide, make up to 250 cc. and use suitable portions for comparison with unknown in Duboscq colorimeter.—*R. E. Thompson.*

Determination of Lead in Water. J. W. HAWLEY AND W. WILSON. Analyst, 62: 166 (1937). Two methods are described which have proved satisfactory for determining as little as 0.01–0.05 part of lead in 100,000 parts of water: (1) Precipitate lead as lead sulfide, in presence of considerably more copper

sulfide, at pH between 4 and 5. Digest mixed sulfides with nitric and sulfuric acid and electrolyze resulting solution. Dissolve deposited lead dioxide in nitric and oxalic acids and determine lead by usual colorimetric sulfide method. (2) Acidify large volume of the water and evaporate to small volume; oxidize organic matter present with potassium chlorate and HCl and then, after removing excess chlorine, dilute the solution, buffer it and saturate with hydrogen sulfide. Dissolve lead sulfide precipitate in concentrated nitric acid and evaporate solution with sulfuric acid to destroy filter. Then, after dilution, filter off the lead sulfate, dissolve in ammonium acetate and subject lead to colorimetric determination as sulfide. Second method is convenient when large number of samples are to be examined, but electrolytic method is better if considerable zinc or copper is present.—*R. E. Thompson.*

A New Reagent for the Detection of Nitrous Acid in Drinking Water. YUAN-YU TSAO AND FU-MING KO. J. Chinese Chem. Soc., 5: 55 (1937). One cc. of water is treated with 1.5 cc. of reagent prepared by mixing equal volumes of benzidine (0.35 gram in 50 cc. glacial acetic acid) and α-naphthylamine (0.27 gram in 50 cc. glacial acetic acid) just before use. Violet color is produced with as little as 0.1γ nitrous acid in 1 cc. Rate of color development is measured. Heavy metal ions interfere.—*R. E. Thompson.*

Determination of Sulfates by the Benzidine Method; Its Application to Water Analysis. J. GOLLAN AND C. CHRISTEN. Anales asoc. quím. argentina, 24: 144 (1936). Benzidine method of determining sulfate is applied, with some modifications, to water analysis, having regard for effect of various substances normally encountered in water, percentage limits thereof and means of avoiding such substances. Good results can be obtained if (1) percentage of sulfate (SO_3) is between 5 and 70 mg. (by dilution or concentration). (2) Weight of dry residue is less than 0.50%; if greater, acidimetric determination of precipitate is difficult; this can be avoided by addition of 1 gram of silica in colloidal solution before precipitation. (3) Iron content is less than 0.01% (as ferric oxide); this ion acts as an oxidant, recognized by green color of solution turning to red; if content is greater than indicated, precipitate with ammonium hydroxide and eliminate ammonia by boiling. (4) Organic material is less than equivalent of 20 cc. of N/80 potassium permanganate, limit rarely met in water. (5) Nitrite content is less than 0.002% (as N_2O_3); presence of nitrites is indicated by yellow color of solution changing to orange, then red, except with water having higher nitrite content than above. Accuracy is about 5%.—*R. E. Thompson.*

Preparation of Ammonia-Free Water by Filtration Through Permutite. YU. OVCHINNIKOVA. J. Applied Chem. (U. S. S. R.), 10: 287 (in German 289) (1937). Water was filtered through 12-cm. layer of permutite at rate of 300 liters per hour. Ammonia content was decreased 93–9.7%.—*R. E. Thompson.*

Sensitivity of Certain Tests for Phenols. V. M. PLATKOVSKAYA AND S. C. VATKINA. J. Applied Chem. (U. S. S. R.), 10: 202 (in German 207) (1937).

Of phosphomolybdic acid, phosphotungstic acid, Millon's reagent and sodium nitroprusside, the first is the most sensitive color reagent for phenols; in presence of ammonia, 1 part in 2,000,000 of phenol, hydroquinone or cresol can be detected. Compounds of mixed function (adrenaline, vanillin, isoeugenol, guaiacol, cresols), as well as α- and β-naphthol and thymol, give color reactions with phosphomolybdic acid in presence of ammonia; these compounds do not give color with phosphotungstic acid. Millon's reagent and sodium nitroprusside give colors with only certain phenols; they do not give colors with above-mentioned compounds of mixed function.—*R. E. Thompson.*

The Usefulness of the Permanganate Number as a Means of Estimating the Comparative Degree of Pollution of Diverse Streams. W. Steffens. Chem.-Ztg., **61**: 307 and 309 (1937). Permanganate number is not reliable when used to compare streams carrying different types of impurities; *e.g.*, those with domestic sewage contrasted with sulfite pulp waste. Laboratory experiments with domestic sewage showed that permanganate consumption rapidly declines with lapse of time because of biological processes until after few weeks it is only 20% of original value. In contrast, sulfite-containing sewage having same original permanganate value showed only very gradual decrease; after many weeks value had not decreased one-third. Field work with streams carrying either domestic or sulfite pulp sewage gave similar results.—*R. E. Thompson.*

The Danger of Using Platinum Dishes in Water Analysis. Jandira Fernandez Lima. Rev. assoc. brasil. farm., **18**: 18 (1937). For analysis of Brazilian waters, frequently rich in nitrates, quartz containers are preferable to usual platinum containers.—*R. E. Thompson.*

BACTERIOLOGICAL

The Fermentation of Propylene Glycol by Members of the Escherichia-Aerobacter-Intermediate Groups. K. Pierre Dozois, Gregory A. Lee, C. Jelieff Carr, Frank Hachtel and John C. Krantz, Jr. J. Bact., **34**: 9 (1937). Because of variation in reactions of *Escherichia coli* and the "intermediates" with propylene glycol, this method, in its present form, cannot be used for differentiation. Close correlation exists between failure to utilize citrate and to ferment propylene glycol by *E. coli*. Relationship between indol formation and propylene-glycol fermentation by *E. coli* has been observed.—*Ralph E. Noble.*

B. Welchii as an Indicator of Pollution in Sanitary Surveys. D. H. Matheson. Can. Pub. Health J., **28**: 241 (1937). In a sanitary survey of Burlington Bay and Lake Ontario in vicinity of Hamilton, 323 samples of water were examined for total bacterial count on agar, anaerobic sulfite-reducing bacteria growing on sulfite-glucose-iron agar and *B. coli*. Tabulation of findings by zones shows definite correlation between results of 3 tests. When individual samples are considered, correlation is not as satisfactory. Ratio of *B. coli* to sulfite-reducing bacteria becomes less as distance from source of pollution increases.—*R. E. Thompson.*

Production of Indole by Indole-Forming Bacteria and Its Relation to the Kind of Peptone Used. A. MASTAFA. Compt. rend. soc. biol., 124: 450 (1937). In media made with Witte's peptone (pH 7.6), about 24 hours is usually required for formation of appreciable amounts of indole by *Es. Coli*. If Martin's peptone (made by peptic digestion of entire hog stomachs) is used, indole can be detected after 2 hours' incubation. Relation between Indole Formation and the Composition of the Medium. Ibid., p. 514. With Witte's peptone, addition of 0.01% potassium nitrate to medium favors formation of indole by *Es. Coli*; with Martin's peptone, reverse is true and 0.02% or more hinders indole formation in either case. Glucose, and to lesser extent galactose, lactose and maltose, inhibit indole formation.—*R. E. Thompson.*

A Culture Medium for the Rapid Detection of E. Coli in Water. V. CIANCI. Bull. soc. ital. biol. sper., 11: 935 (1936). Source of nitrogen is peptone and aerobic fermentation of lactose is facilitated by presence of suitable amount of phosphate buffer (pH 6.8) corresponding to pH zone for maximum development of *E. coli*.—*R. E. Thompson.*

The Variability of Coli and Colon-Type Bacilli Isolated from Sewage. CARL NYBERG, KATRI BONSDORFF AND KAARINA KAUPPI. Zentr. Bakt., Parasitenk. 1 Abt. Orig., 139: 13 (1937). Strains which do not ferment glucose will usually not ferment any carbohydrate. Formation of acetylmethylcarbinol (Voges-Proskauer reaction) did not vary and is best means of differentiating *Aerobacter* from *Escherichia*.—*R. E. Thompson.*

Experiments to Devise a Better Procedure for Making Bacterial Counts than that Outlined in Standard Methods. GLENN GREEN. Ann. Rept. Ohio Conf. Water Purif., 1936, 77. In order to prevent instant solidification of a portion of the agar, as occurs when medium is poured on to cold water, the petri dishes were warmed in the incubator, agar at temperature of 40–41°C. introduced and the desired amount of sample, previously warmed to 35–40°C., added, the whole then being mixed thoroughly. The average count on 100 plates prepared by this procedure was 157.4 compared with 228.7 on parallel plates prepared in usual manner.—*R. E. Thompson.* Editor's Note: Further research appears necessary before broad conclusions can be drawn from the author's investigations.

Changes in the Properties of the Typhoid Organisms Induced Through Retention in Drinking Water and Effluent. S. RUCHKOVSKIĬ AND M. LINCHEVSKAYA. Zentr. Mikrob. No. 15; 820 (1936); Wasser u. Abwasser, 34: 315. Typhoid bacteria were kept in collodion sacks immersed in (1) drinking water, (2) river water and (3) polluted river water. Organisms were viable up to 3 weeks in (1) and 6 weeks in (3). Organisms kept for 5 weeks in (3) no longer agglutinated. Ability to ferment lactose, glucose, mannitol and maltose was lost. Shortly before loss of complete viability, some organisms produced numerous granules which upon inoculating on agar gave rise to typical typhoid colonies. This change in form makes detection in water even more difficult.—*R. E. Thompson.*

CHEMICAL

Rapid Examination of Drinking Water for Toxic Substances. DUFILHO, E. Chim. et Industr., 37: 260 (1937). Describes a number of tests for toxic materials which may be made on a suspected water. Mineral chlorides or bromides are detected by the formation of a blue color with starch iodide paper. After the addition of 1 cc. pure sulphuric acid and boiling, the production of a gas which blackens lead acetate paper indicates hydrogen sulphide; if the gas turns guaiacum paper blue hydrocyanic acid is present and if it decolorizes litmus paper it is sulphur dioxide. The presence of tannins and phenolic compounds is detected by the brown, green, blue or black color obtained on the addition of a drop of ferric chloride to 10 cc. of water. Rapid methods are also described for the detection of copper, lead, arsenic, antimony, zinc, phosphate, and certain alkaloids such as nicotine, conicine, aconitine, brucine, colchicine, atropine, and morphine.—*W. P. R.*

Effect of Burning Temperature and Various Admixtures upon the Rate of Slacking of Lime. P. P. BUDNIKOV AND L. G. GULINOVA. Ukrain. Khem. Zhur., 11: 275 (1936). Experiments carried out with aid of diphenylmethane calorimeter and summarized in 7 tables and 2 graphs show that heat is evolved at highest rate in slacking of lime made from marble or chalk burnt at 1100°C. Addition of 1% aluminum, alkali or alkaline earth salts markedly accelerates slacking of lime.—*R. E. Thompson.*

New Inhibitor Theory and New Method for the Evaluation of Inhibitors. W. MACHU. Korrosion u. Metallschutz, 13: 1 (1937). Inhibitive action of 11 different substances, i.e., ACP Rodine, di-*o*-tolylthiourea, Ferrocleanol Supra H, Aussiger Sparbeize, dibenzyl sulfide, dibenzyl sulfoxide, quinoline, starch, gum arabic, gelatin and Turkish-red oil, on solubility of iron in dilute sulfuric acid and their influence on free pore surface F_o–F and the layer resistance w, was investigated. Method of determining passivifying period t_p and initial current intensity i_o was used and average of 0.66 for free surface was obtained. This eliminates theory that protective action of the adsorption layers is due to their low porosity. All inhibitors formed adsorption layers of considerable electrical resistance. This resistance increased with concentration of inhibitor. It is concluded that any organic substance capable of forming adsorption layer with resistance of 3 ohms will show good inhibitor performance. This resistance is assumed to be due to narrowness of interstices between molecular chains or micellar capillaries, which greatly decreases rate of diffusion or transfer. Layer resistance, being common to all inhibitors, permits evaluation of inhibitive characteristics on purely physical basis independently from constitution, concentration, surface tension, overvoltage, viscosity, dissociation, electrical charge, etc. Adoption of layer resistance of 3 ohms as definition for inhibitors is suggested. Seven references.—*R. E. Thompson.*

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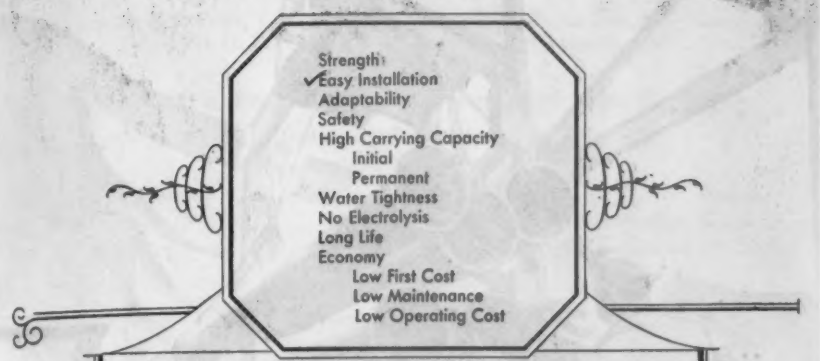

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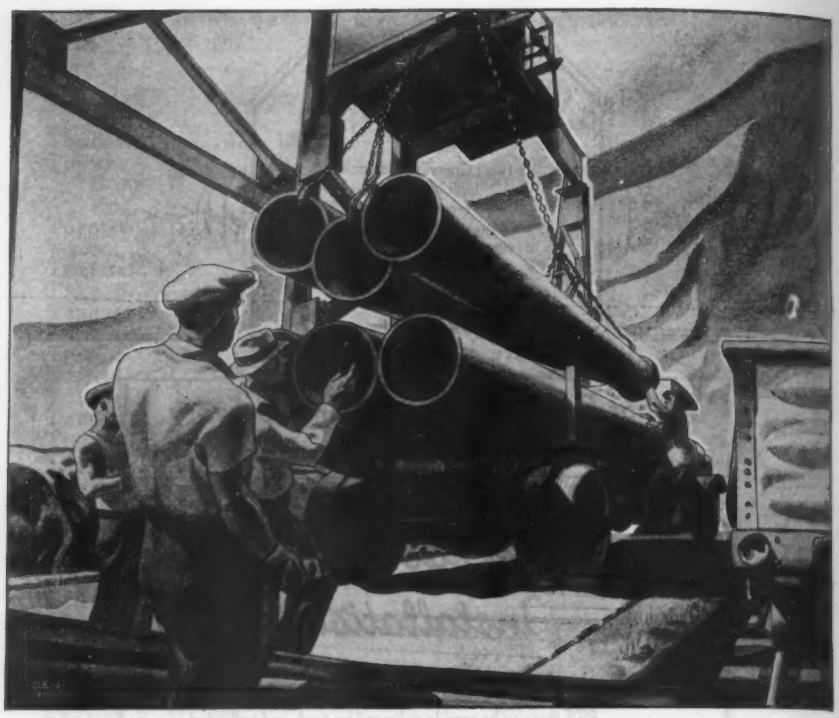

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COMING MEETINGS

March 30–April 1—Florida Section—Place to be announced later. Secretary, J. R. Hoy, 404 Hildebrandt Bldg., Jacksonville, Fla.

April 6–8—Southeastern Section—Place to be announced later. Secretary, W. H. Weir, State Board of Health, 135 State Capitol Bldg., Atlanta, Ga.

April 12–14—Kentucky-Tennessee Section—Hotel Patten, Chattanooga, Tenn. Secretary, H. D. Schmidt, Associate Director, Division of Sanitary Engineering, State Health Department, Nashville, Tenn.

April 14–16—Canadian Section—Hotel Windsor, Montreal, Canada. Secretary, A. E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ont., Canada.

April 19–22—Montana Section—Lewistown, Mont. Secretary, H. B. Foote, Director, Division of Water & Sewage, State Board of Health, Helena, Mont.

April 22–23 1937—Four States Section—Philadelphia, Pa. Secretary, Carl A. Hechmer, Department Engineer, Washington Suburban Sanitary District, Hyattsville, Md.

April 29–30—Illinois Section—Springfield, Ill. Secretary, W. D. Gerber, Engr., State Water Survey Division, 406 Florida St., Urbana, Ill.

May 20–22—Pacific Northwest Section—Empress Hotel, Victoria, B. C. Secretary, Fred Merryfield, Assistant Professor of Civil Engineering, Oregon State College, Corvallis, Ore.

June 7–11—Annual Convention of American Water Works Association—Statler Hotel, Buffalo, N. Y. Secretary, Harry E. Jordan, 29 W. 39th St., New York, N. Y.

August 18–20—Central States Section—Dearborn Inn., Dearborn, Mich. Secretary, H. Lloyd Nelson, U. S. Pipe & Foundry Co., 2122 Koppers Bldg., Pittsburgh, Pa.

October 11–14—Southwest Section—Austin, Tex. Secretary, L. A. Quigley, Superintendent, City Water Works, 3320 W. Berry St., Fort Worth, Tex.

October 20–23—California Section—Place to be announced later. Secretary, Carl M. Hoskinson, Chief Engineer, Division of Water, Sacramento, Calif.

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BURNS, I. M., Supt., Water & Light Dept., Cherryville, N. C.

KEARNEY, E. W., State Board of Health, Mount Airy, N. C.

OLSEN, WILLIAM C., Cons. Engr., Raleigh, N. C.

TOLLES, FRANK C., Civil & San. Engr., Leader Bldg., Cleveland, O.

VAN CLEAVE, S. M., Supt., City Water Dept., Marion, Ind.

Resignation

MCCLELLAN, THOMAS D., United Piece Dye Works, Lodi, N. J.

Transfers Between Sections

CHARLES, ROBERT S., JR., New Jersey Section to Canadian Section

HOLDREDGE, NEIL C., New Jersey Section to New York Section

KIKER, JOHN E., JR., Four States Section to New York Section

NEWS OF THE FIELD

The death of Nicholas Snowden Hill, Jr., on October 18, was a shock to his hundreds of friends in the engineering and water works field throughout the United States. Mr. Hill has had active part in the water works field for many years, both from an engineering and operating point.

In 1922, he became a director of the Hackensack Water Co., being elected to the presidency in 1926 to succeed the late Robt. W. deForest. This company now supplies fifty municipalities in North New Jersey, with a population of 400,000.

He had been a member of this Association since 1901. He was its President in 1916 and was made an Honorary member in 1936. In addition he belonged to the American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Municipal Improvements, National Conference on City Planning, New England Water Works Association, and the New York State Sewage Association.

Under an agreement with the Executors of the estate, Messrs. George H. Buck, William P. Seifert and Charles F. Jost have taken over the office and business of Mr. Hill. They are operating under the name of "Nicholas S. Hill Associates."

Mrs. Jane Hoimark, of Newark, N. J., long a member of the Wallace and Tiernan staff, died on January 2, 1937, after a protracted illness. One of those remarkable women of the modern world who combine charm and tact with efficiency and energy, as secretary to Wm. J. Orchard, she contributed greatly to the success of her organization.

Frederick Manville, Superintendent of Water Works and Assistant Manager, Newport News, Virginia, died at his home in that city recently. His loss is keenly felt in that city and his wide circle of acquaintances throughout the country. He had, for many years, been an active member of the American Water Works Association, and was a familiar figure at conventions of the Association.

A manual of water works accounting practice is to be prepared by the Finance and Accounting Division of the American Water Works Association working in co-operation with the Municipal Finance Officers' Association of the United States and Canada. This project was formerly scheduled for undertaking by a direct sub-committee of the Water Works Practice Committee, designated Committee 11. Early last year the Water Works Practice Committee transferred this project to the Finance and Accounting Division and in August, 1936, the suggestion was made by the Municipal Finance Officers' Association that the project be undertaken jointly, and that if that were done they could attend to the financing of it.

(Continued)

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(*Continued from page 1*)

This most timely offer of co-operation met with the hearty approval of our Association officials, and organization for the work is proceeding as rapidly as possible with the hope that the manual may be in form for preliminary consideration at the convention in Buffalo next June. The manual will be designed primarily for water works plants in cities of 100,000 population and less. It will contain a minimum of theory and will outline suggested actual accounting procedure throughout all phases of water works operation. It will probably make recommendations as to classification of accounts but no new classification will be included.

The Municipal Finance Officers' Association with whom our Association is co-operating in this work is an association of Public Officials engaged as finance and accounting officers of State and local governments. Its headquarters are in Chicago at the Public Administration Clearing House and it is financed by the Spelman Fund. Mr. Charles T. Sweeney, C. P. A., of Springfield, Ohio, has been appointed to carry on its share of the work in preparing the manual. Mr. Hal F. Smith, of Detroit, chairman of our Association's Finance and Accounting Division, is representing our Association in the organization of the work. The committee personnel has not yet been announced.

(*Continued*)

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SAVE 80% ON YOUR TRENCHING COSTS WITH A
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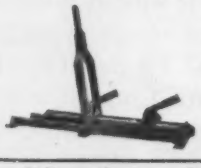
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This Jointing Compound is a GOOD TRAVELER!

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Help Build up Your Association by Bringing in a New Member

SEND FOR APPLICATION BLANKS

American Water Works Association

29 W. 39th St. **New York City**

(*Continued from page 5*)

The Dorr Company have moved their New York offices to 570 Lexington Avenue. Their first Metropolitan office was established at 30 Church Street in 1913. The new quarters include a permanent display of models of Dorrco equipment, much of which is familiar to the water treatment field.

Hydrant manufacturers have brought the water works industry a long way from the condition described by the Burton (Eng.) Daily Mail of June 8, 1936.

"Everyone is familiar with the metal plates affixed to walls or palings, and which bear the sign F. P. — Feet. They indicate the distance to the nearest fire plug or point at which the hose of a fire brigade may be connected. These facilitities have, however, not always been there, and an interesting sidelight on the fire-fighting methods of a century ago has been discovered in a directory of 1818. A resolution was passed by the Commissioners of Water Works, whereby the inhabitants have full liberty in all cases of fire that may happen where the serving pipes of the water works extend, to dig down to the pipes, in the most convenient situation, and to cut the same through with a saw, which may very easily be done,

(*Continued*)

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FILTER SAND
98% Pure Silica

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Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

YOUR DOLLAR'S WORTH IN A METER SETTING

It is just as much false economy to set a water meter in the cheapest way as it is to do the plumbing of a house in the cheapest way—

●

A water meter set in a Ford Yoke or in a Copperhorn Meter Coupling can be easily removed and replaced without disturbing the service pipe—

●

This one fact alone justifies what slight extra cost there may be—

THE FORD METER BOX CO.
Wabash, Ind.
Water Meter Setting and Testing Equipment

Ford Yoke for Setting on Risers

Straight Line Yokes for shallow meter box or basement settings in horizontal piping

Saves Couplings *Saves Fittings*

Ford Copperhorn Meter Coupling

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This NEW PIPE HANDBOOK

- 48 Pages of Useful Information
- More Than 25 Helpful Tables and Charts
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- Recent Data On Soil Corrosion Studies
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To get your free copy of this new Armco Pipe Handbook, address a post card or letter to: The American Rolling Mill Company, Pipe Sales Division, Dept. J-1, Middletown, Ohio.

ARMCO

ARMCO SPIRAL WELDED PIPE
For Water Supply Lines

(*Continued from page 10*)

as they are of lead. On the first alarm of fire it was requested that application be made to either Robert Simpson, of ————————, or James Walker, of ———————— , who were directed to turn the water on and assist the diggers down to the pipes. A list of places where the town's water pipes could be found was given together with a list of the fire engines available."

The appointment of Charles J. Alfke as manager of the Hackensack Water Company is announced by Henry L. deForest, president of the Company. Mr. Alfke has been controller since 1924. He is succeeded in this post by William J. Schwartz, who has been chief accountant.

For eleven years prior to joining the Hackensack Water organization, Mr. Alfke was engaged in industrial management and professional accounting. He was associated with George W. Goethals and Company for three years, being assigned to management duties with the Wright Martin Aircraft Corporation and the Splitdorf Electrical Company. He was also connected with the Willys Corporation, Elizabeth, N. J., as auditor, and with the Pacific Development Corporation in the administration of subsidiaries operating in the importing and exporting, and manufacturing fields.

(*Continued*)

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

CHURCH AND DEY STREETS

NEW YORK CITY

End supports 34 feet apart. 100 lbs. pressure still in line and deflection of over 11 inches with joint still tight.

ELIMINATE THAT LEAKAGE

LEAKY joints have a bearing on many of the problems which water company and water department officials are continually faced with. Unaccounted for water—excessive pumping charges—digging up costly pavements—even renewing pipe lines on account of lowered carrying capacity. Many of these worries can be avoided by making all new joints with Hydro-Tite.

Should a pipe line jointed with Hydro-Tite settle, as shown in the above picture, the joints will remain tight. Lines jointed with Hydro-Tite remain tight year after year and systems completely installed with Hydro-Tite joints are the tightest on record.

Hydro-Tite joints never blow out—have a record of over 20 years—require no caulking and save from 50% to 75% as compared with lead Write for information on any phase of joint making.

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Since 1860 we have manufactured:

Water Meters
Compounding Valves
*Corporation and Curb Cocks
*Flared Copper Tubing Fittings—Heavy Pattern
*Chronometer Valves
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*Steam and Air Controlled Fire Signals

*New 1937 Catalogues Now Available

UNION WATER METER COMPANY

Established 1860

WORCESTER **MASSACHUSETTS**

(*Continued from page 14*)

Mr. Alfke received the degree of bachelor of commercial science from the New York University School of Commerce, Accounts, and Finance in 1915. He studied materials engineering and chemical engineering at the Polytechnic Institute in Brooklyn. He is forty-four years old, and a native of New York City.

The Minnesota Section of the A. W. W. A. at its recent meeting in Minneapolis adopted a report which recommended the organization of a Water Works Operators School. The committee appointed to organize and conduct the first session consists of:

Arthur F. Mellen, filtration engineer, Minneapolis Water Department (representing Minnesota Section, A. W. W. A.), chairman.

Frank Raab, chemist and bacteriologist, Minneapolis Water Department (representing Minnesota Section, A. W. W. A.)

Dr. M. McC. Fisher, Health officer, Duluth (representing Minnesota Sanitary Conference).

H. A. Whittaker, director, Division of Sanitation, State Board of Health.

Ben Hunt, water superintendent, Bemidji.

R. L. Van Nocker, city manager, Albert Lea.

(*Continued*)

Modern conditions demand SAFETOPS

30 YEARS AGO, traffic moved at a leisurely pace, fire engines were horse drawn, municipal water supply pumps were driven by reciprocating engines and operated at efficiencies of 60% or 70%—***and fire hydrant design was in a similarly elementary stage.***

Today, practically all municipal equipment has been thoroughly modernized, and traffic conditions have completely changed—***but have your fire hydrants kept pace with this progress?***

Are you still using hydrants with high friction loss, hydrants with stiff or complicated operating mechanisms, hydrants with excessive maintenance expense, or hydrants that cause flooding, require excavation and complete replacement if accidentally broken?

Here are two suggestions that will help you to modernize your fire hydrants. *First*, install Kennedy SAFETOPS on all new extensions. *Second*, replace broken fire hydrants with Kennedy SAFETOP Adapters. Each Kennedy SAFETOP installation will relieve your department of one less source of maintenance and repair expense, and will be welcomed by the fire department because of its easy operation, quick response, and low pressure loss in fire service.

Send for Bulletins

The Kennedy Valve Mfg. Co.
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KENNEDY

SAFETOP FIRE HYDRANT

REG. U.S. PAT. OFF.

First Quality Meters Exclusively

SPECIFY

AMERICAN
(BRONZE CASE)
OR
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(IRON CASE)
WATER METERS
For Unrivalled Accuracy
WRITE FOR CATALOG

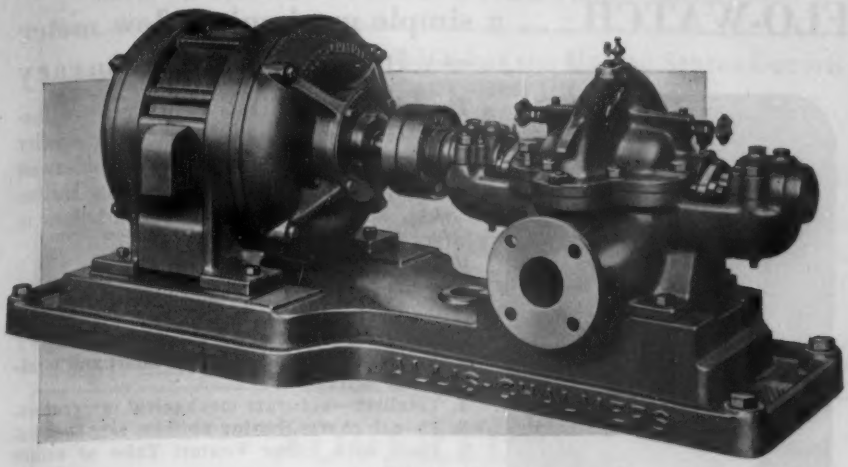
BUFFALO METER CO.
ESTABLISHED 1892 2914 Main Street Buffalo, N. Y.

(*Continued from page 18*)

For maximum efficiency, the delivery of a centrifugal pump should be controlled by varying the speed. This is especially true when pumping directly into the distributing piping. The comparative economies of constant speed and variable speed drives for pumps and the several methods of obtaining variable speed are discussed by A. Peterson, Chief Engineer of the Centrifugal Pump Department of the De Laval Steam Turbine Co., Trenton, N. J., in a paper which has been reprinted from the JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION and which will be sent gratis to those interested.

A new American Standard for Pipe Plugs has just been issued by American Standards Association Sectional Committee B16 on which this Association is represented by Messrs. Frank A. Barbour and William W. Hurlbut. This committee's work covers the standardization work on pipe flanges and fittings. The present specification covers only screw plugs of the types generally used in screw pipe fittings. From the beginning these plugs have been made with the American Standard Taper Pipe Thread, but the design of the heads used for screwing these plugs into fittings or any tapped hole has been a matter of manufacturers' and users' individual design. As these plugs are not only used in connection with pipe fittings

(*Continued*)



. . . a widely used unit *for*

General Purpose Pumping

One of the most popular of the many types of Allis-Chalmers centrifugal pumping units is the type "S", for handling general pumping requirements. This is an improved double suction, split-casing, bronze fitted, horizontal shaft pump designed for long service and high efficiency at a reasonable cost.

Type "S" units, both pump and motor are built by one company and sold as combined units, give the most pumping value per dollar. All parts, including base plate, are taken from stock with the pump runner selected to meet the requirements for the particular service intended. Then the unit is tested for head, capacity, and efficiency.

Standard Type "S" Units are built in capacities from 30 to 50,000 g.p.m. and for heads up to 300 ft. These together with other types of single and multi-stage Allis-Chalmers pumps, so satisfactorily take care of most pumping requirements that it should pay you to write for our recommendations when considering pumping equipment. *Write for Bulletin 1650.*

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FLO-WATCH . . . a simple mechanical flow meter —with unusual accuracy

The **FLO-WATCH** is an inexpensive mechanical meter, designed for use in smaller community water plants which otherwise would have to do without Recording Instruments; and for the less important lines in larger plants.

Features:

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2. **Universal mounting—wall, floor, or panel.**
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4. **Totalizer—accurate mechanical integration.**
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7. **Used with water, steam, air, or gas.**

AND, IF DESIRED:

8. **Direct reading charts and dials—in any units.**
9. **Remote indicating or recording instruments.**

Bulletin 284 describes this latest Instrument in the list of Builders Iron Foundry Water Works metering and controlling equipment—a copy will be sent upon request, address:

BUILDERS IRON FOUNDRY . . . Providence, R. I.

(*Continued from page 22*)

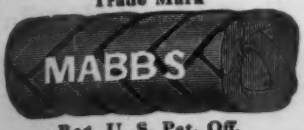
but in many other services where it is necessary to plug up a hole, such as drain connections on equipment of all kinds, these plugs are used in large quantities by the automobile industry and builders of machinery. Accordingly, the dimensions of the heads and the sockets have been made to conform to the sizes of standard open end wrenches and the maximum dimensions of standard hot rolled steel bars, respectively.

The new standard is designated as B16 e2–1936 and may be obtained in pamphlet form from the American Standards Association, 29 West 39th St., New York City, at a price of $0.35.

Arthur T. Clark has resigned his position as Superintendent and Engineer of the Department of Water, Morristown, N. J. He has associated himself with the Barrett Co. of New York City. For the purpose of developing sales of their pipe coating materials in the water works field the Barrett Co., New York, through its pipe coating department, has published a well illustrated and fully explained book on Pipe Coating Specifications for Field Applications. Methods of laying, coating, and materials used for coating of pipes are fully described.

(*Continued*)

Trade Mark



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WHY has the United States Government used the

MABBS RAWHIDE PACKING

for over twenty-five years on their hydraulic dredges?

BECAUSE: It prevents wear and cutting of shafts and valve stems when handling dirty or sandy water, and it lasts much longer than other packings.
It is ANTIFRICTIONAL and will save enough in Power to pay for itself in a short time.
Try it and prove this to your own satisfaction.

WE MAKE A SPECIALTY OF RAWHIDE METER WASHERS

MABBS HYDRAULIC PACKING COMPANY

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For the Presumptive Detection of Coli

Bacto-Lactose Broth is the medium of choice for the presumptive detection of *Escherichia coli* in water. When the dehydrated medium is prepared for use in the laboratory it conforms in every way to the requirements of "Standard Methods of Water Analysis" of the American Public Health Association. It requires no further adjustment of its reaction or filtration of the solution. After the usual autoclave sterilization it will have a reaction of pH 6.6.

Fermentation tubes of medium prepared from Bacto-Lactose Broth which have been inoculated with the water sample will yield reliable and accurate results after incubation according to usual practice. Positive presumptive tests are readily confirmed upon plates of medium prepared from Bacto-Endo's Agar or Levine's Eosin Methylene Blue Agar, Difco or in tubes of the new liquid confirmatory media which are also available in dehydrated form.

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

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RELIABLE EMERGENCY POWER

costs so little initially and so little to maintain!

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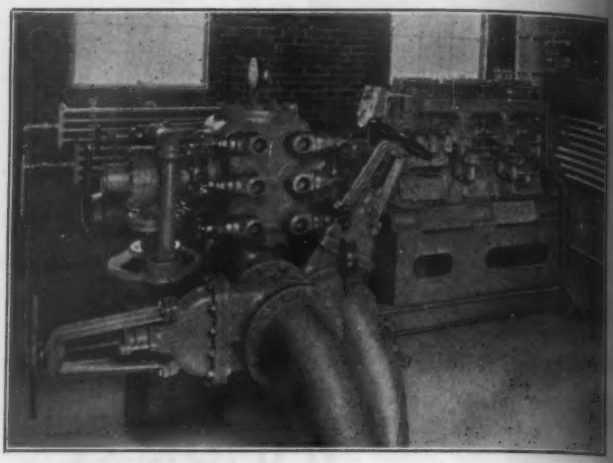
Sterling

INTERNAL COMBUSTION ENGINES

Spread the cost of a Sterling engine over the 20 to 30 years it is intended to serve! For an infinitesimally small amount annually, you can obtain the assurance that only a Sterling is built to provide.



The Mount Hope Finishing Co., North Dighton, Mass., is prepared for power in emergency with a Sterling Dolphin C 6-cylinder 225 H.P. engine driving a 1500 G.P.M. Worthington fire pump at 1330 R.P.M.

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900 Chrysler Bldg.
New York, N. Y.

(*Continued from page 28*)

The Social Security Act has been the occasion of a number of letters and inquiries to the Association headquarters. Information received to date is very definite to the effect that all municipal employees, including the employees of municipally owned utilities, are excepted from the provisions of the Act.

Nothing but guesses can be given as to the reason for this exception. It may be due to legal question as to the right of the Federal Government to tax the employers of municipal employees. Another consideration may have been the fact that in many states there is already legislative provision for municipalities to set up retirement pension systems for their employees. Public School teachers are also excepted from the Social Security Act.

Frequently remarked upon has been the apparent inconsistency of the government in discriminating against water department employees as to the payment of income tax, and yet classing them with other municipal employees in excepting them from the Social Security Act benefits. However, the income tax matter is not yet settled, and there is always a possibility that rulings under the Social Security Act may be modified. It has been suggested that it might be made *optional* with municipalities to place their employees under the Social Security Act, or not.

(*Continued*)

(*Continued from page 32*)

Bulletin No. 605 of Hellige, Inc. announces a series of new comparators now being manufactured in their Long Island City plant which are constructed of Textolite, a corrosion resistant, plastic material, manufactured and molded by the General Electric Company. This material is affected neither by acids or alkalis, nor by laboratory fumes. By using this material they have been able to incorporate many new features.

The Union Water Meter Co. of Worcester, Mass. advise that their plant will run double shift for some time now, in view of the fact that they are booked into February for delivery of orders which are accumulating at the present time. This company has undergone a radical change in policy and personnel and the sales for 1936 have already exceeded those for the past five years by quite a substantial margin.

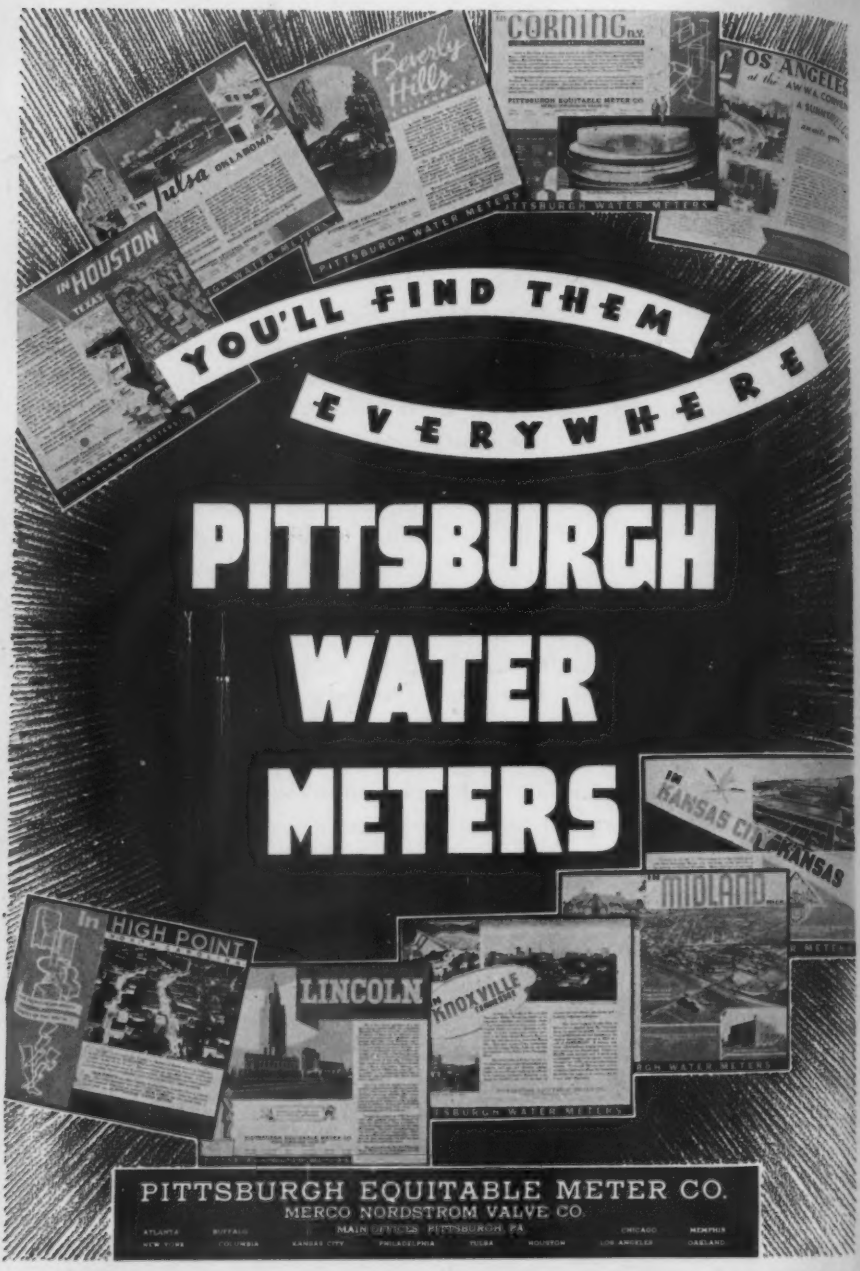
The Spring Meeting of the New York Section will be combined with the Annual Convention of the Association at Buffalo—June 7–11.

America needs 6,700,000 new homes today! New construction for the first nine months of 1936 exceeded new building for all of 1935 by 23 per cent. Contracts awarded for the past August registered the largest monthly total in more than five years. Seventy per cent of all these new homes are single and two-family dwellings. There is every probability that America is headed into an extended period of building activity with home building predominating. Of thirty million dwelling units now standing in this country not many more than a million are less than ten years old.

With this issue, under the caption "News of the Field," there is resumed the informal section of the JOURNAL formerly called the "Supplement." In its columns you may expect to find news notes of every variety—new products, new catalogues or bulletins, current association activities, news of the sections, doings of committees, personals, organization changes, topic stories from other fields, occasional humor. In it you may even find reference to that end of the road which all men reach.

No creaking plan will guide, no system will govern. If it is news and interesting to water works men and we happen to learn of it, you will find it noted here.

You have grown to think of this JOURNAL as a thoroughly dignified and well edited publication. It is hoped to add a bit of affability to its other good qualities. Hence the yellow cover, a good fire hydrant color, put on the magazine for the same purpose that it is put on hydrants—high visibility. We hope it may also remind men in the field that the JOURNAL is just as essential to an efficient water works man as a hydrant is to an efficient water works system.



PITTSBURGH WATER METERS

NEWS OF THE FIELD

History is always interesting. Younger members of this Association will be interested in excerpts from the little brown volume which contains the records of the first six meetings.

"Pursuant to a call issued by W. C. Stripe, Secretary and Superintendent Keokuk Water Company, the following officers of water companies and those interested, met in convention in Engineers Hall, Washington University, St. Louis, Mo., March 29, 1881:

W. C. Stripe, Keokuk, Iowa; H. G. Belche, Peoria, Ill.; James Millard, Peoria, Ill.; M. Donohue, Davenport, Iowa; Alex. Chuse, Bloomington, Ill.; Charles A. Smith, St. Louis; J. H. Decker, Hannibal, Mo.; H. D. Wood, Hannibal, Mo.; J. G. Briggs, Terre Haute, Ind.; John W. Harrison, St. Louis; John Long, Louisville, Ky.; F. L. Kimball, St. Louis; Sylvester Watts, St. Louis; J. B. Quigley, Atchison, Kan.; Wm. H. Burnham, Batavia, Ill.; W. L. Cameron, Memphis, Tenn.; T. J. Rembert; C. E. Gray, St. Louis; Wm. Ratekin, Jacksonville, Ill.; and Col. J. T. Foster, Chicago."

The first president of the A. W. W. A. was Col. J. T. Foster of Chicago, Illinois. The first secretary was J. H. Decker of Hannibal, Mo.

As the Association prepares for its 57th annual convention at Buffalo in 1937, it should be interested to note the program of the 3rd meeting held in Buffalo in 1883. The list follows:

The consumption of smoke, or smoke burners of water works boilers. Ira A. Holly, Burlington, Ia.

The relative economy of constant and intermittent pumping. W. C. Stripe, Keokuk, Ia.

The methods of filtration of water in use in the United States and Europe, with details of construction, cost and efficiency. J. James R. Croes, New York City.

The relative economy to towns of a supply of water under municipal control, and under control of private corporations. J. G. Briggs, Terre Haute, Ind.

Plumbing work; its effect on the health of the family. Peter Milne, Jr., Brooklyn, N. Y.

(Continued)

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(*Continued from page 1*)

The operation of hydraulic elevators; difficulties found in their service, and remedies for the same; also, amount of water used by water motors supplied from mains. B. F. Jones, Kansas City.

Subsidence and filtration of Western river waters, and availability of natural flow into filtering wells and galleries. G. W. Pearsons, Kansas City, Mo.

The use of iron or steel tanks. Thos. J. Bell, Cincinnati, Ohio.

Systematic compilation of annual reports. J. T. Foster, Chicago, Ill.

Records of engine duties. Frank W. Holly, Lockport, N. Y.

How can the quantity of water passing through a water main which is in operation, be ascertained? Geo. A. Ellis, Springfield, Mass.

How important a factor in the economic management of water works is engine duty? Prof. Chas. A. Smith, St. Louis, Mo.

Repair and maintenance of machinery, valves, hydrants, etc. Thos. J. Whitman, St. Louis, Mo.

The man who said that history repeats itself should have said that history flows on. The topics of 1882 are still in essence the problems of 1937 and will yet be the problems of 1980, when the one hundredth convention is held.

(*Continued*)

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Chemical and Bacteriological Analyses of Water, Sewage and Industrial Wastes.
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CAST IRON PIPE

Sizes 2" to 84"

Flanged Pipe ***Flexible Joint Pipe***

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Special Castings ***Short Body B. & S. Specials***

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WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

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Minimizes Friction—

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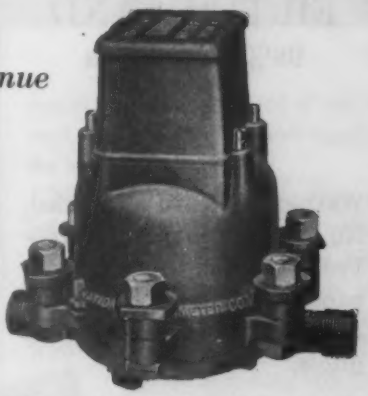

The L. H. Nash Water Meter is *designed* to minimize friction. The Nash V-type Disc, for example, with its free control, functions much more easily and with less friction than where a mechanical control device is employed. Then, too, this disc is carefully balanced, easy running, highly sensitive to small flows . . . all promoting maximum revenue.

The L. H. Nash Water Meter is also *manufactured* to minimize friction. The disc alone must pass seven exacting inspections, including measurements made in ten-thousandths of an inch, before final acceptance.

Other features, too, invite investigation . . . write for complete information.

NATIONAL METER COMPANY

4203 First Avenue, Brooklyn, N. Y.

BOSTON CHICAGO DALLAS LOS ANGELES SAN FRANCISCO

(*Continued from page 5*)

The championship for long-term discussion of quality of a water supply apparently should be awarded to a case recorded in the Official Circular of the British Waterworks Association.

"The Dean and Chapter of Canterbury Cathedral were summoned at Canterbury on 25th October, in respect of an alleged polluted water supply at two houses in the Precincts. The Town Clerk (Mr. G. W. Marks), who appeared in support of the summons, said that there was a charter granted by Henry VIII in 1546 in which it was stated that the water even then was contaminated by deer in King's Park. Some work had been done during the past six months, but samples since taken showed that the water was contaminated, at any rate after heavy rain. One witness had said it looked like iced coffee. Mrs. Maitland, a householder, said that after heavy rain the water looked like thick orangeade. She always boiled and filtered it before use. Samuel Jeffery, sanitary inspector, said that the water came from a spring and wells at Scotland Hills, near the city. Samples showed that the supply was all right except after heavy rain. Edward Hawkins, public analyst, reported that a sample submitted to him

(*Continued*)

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It is just as much false economy to set a water meter in the cheapest way as it is to do the plumbing of a house in the cheapest way—

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This one fact alone justifies what slight extra cost there may be—

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Water Meter Setting and Testing Equipment

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HERE'S PROOF

of Reliability in Waterworks Service

FORTY YEARS AGO these crude riveted iron and steel water mains were installed in San Francisco Bay. When last examined, in 1933, they were in *good condition.*

Other installations of comparatively thin-walled iron and steel pipe are functioning efficiently after even longer periods of service. And remember, in those days little was known about protective coatings for underground service. This means that the satisfactory performance record of iron and steel pipe must be attributed largely to the metal itself.

Now with improved coatings and linings, plus wall thicknesses designed to meet local conditions, modern Armco Spiral Welded Pipe will meet your requirements even more satisfactorily. Write for the facts. Address The American Rolling Mill Company, Pipe Sales Division, Department J-2, 709 Curtis Street, Middletown, Ohio.

ARMCO

ARMCO SPIRAL WELDED PIPE

(*Continued from page 10*)

contained a great deal of clay and must be considered unsatisfactory. Dr. C. Ponder, deputy county bacteriologist, who examined samples of the water, said that his conclusion was that it was obviously seriously contaminated and unsuitable for drinking. In August he examined a sample which was very bad and there was evidently serious contamination. Mr. J. G. Pembroke, solicitor, for the Dean and Chapter, said they wanted to put the matter right if possible, otherwise the supply would have to be closed; but were first anxious to have further samples taken. The supply seemed to have originated in 1130 under Prior Wybert, and was probably one of the oldest water supplies in the country. Work had been done to take off the surface water. People had been drinking that water 800 years and he could not think there was much the matter with it. The case was adjourned for six weeks on payment of £5 5s. costs for further analyses."

In the case of a supply recorded as contaminated in 1546, it would hardly appear necessary to await further analyses in 1937.

Frank Bachmann of The Dorr Co. left on January 23rd for England to study British sewage treatment methods.

(*Continued*)

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Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

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Modern conditions demand SAFETOPS

30 YEARS AGO, traffic moved at a leisurely pace, fire engines were horse drawn, municipal water supply pumps were driven by reciprocating engines and operated at efficiencies of 60% or 70%—***and fire hydrant design was in a similarly elementary stage.***

Today, practically all municipal equipment has been thoroughly modernized, and traffic conditions have completely changed—***but have your fire hydrants kept pace with this progress?***

Are you still using hydrants with high friction loss, hydrants with stiff or complicated operating mechanisms, hydrants with excessive maintenance expense, or hydrants that cause flooding, require excavation and complete replacement if accidentally broken?

Here are two suggestions that will help you to modernize your fire hydrants. *First*, install Kennedy SAFETOPS on all new extensions. *Second*, replace broken fire hydrants with Kennedy SAFETOP Adapters. Each Kennedy SAFETOP installation will relieve your department of one less source of maintenance and repair expense, and will be welcomed by the fire department because of its easy operation, quick response, and low pressure loss in fire service.

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SAFETOP FIRE HYDRANT
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WATER METERS
For Unrivalled Accuracy
WRITE FOR CATALOG

BUFFALO METER CO.
ESTABLISHED 1892 2914 Main Street Buffalo, N. Y.

(*Continued from page 14*)

The President of the United States, in his address at Montevideo on December 3, 1936 had certain things to say that were of direct interest to water works men.

"In the case of agriculture the United States did many things in the past which ran counter to the laws of nature and of sensible economics. In many parts of my country we have used the land in such a way as to diminish its productiveness, we have harmed our supply of water and we have lost our top soil. Today our Government seeks to work with our farming population in correcting these mistakes and in bringing back a greater prosperity and a more permanent use of the land. We seek new remedies for new conditions; new conditions will continue to arise; sometimes the remedies succeed, and sometimes they must be altered or improved. But the net result is that we move forward."

To clarify its position as a non-profit service corporation Underwriters' Laboratories has been reorganized without capital stock, the new corporation to be known as the Underwriters' Laboratories, Inc. There will be no changes whatever in the management and technical personnel and no

(*Continued*)

A THREE-WAY CUT IN WATER-CARRYING COSTS!

1. Saves on Installation

Transite Pipe is light. Every handling represents a saving. And Transite's Simplex Couplings, requiring no caulking, are rapidly and economically assembled by unskilled labor.

Result—profitable savings in time and money that lower installation costs!

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Transite Pipe, because of its asbestos-cement composition, provides your best assurance of permanence. It is immune to electrolysis and tuberculation, highly resistant to soil corrosion.

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Because it cannot tuberculate under any circumstances, Transite Pipe maintains its initial high delivery capacity indefinitely. Its initial flow coefficient, conservatively estimated at C-140, remains at that figure throughout Transite's long years of service.

Result—pumping costs on Transite lines stay permanently low!

Hence Transite Pressure Pipe effects the three-way cut in water-carrying costs that promises you a permanently economical pipe line. Send for our free, illustrated brochure. It will tell you all you want to know about the advantages Transite offers to water transportation. Write to Johns-Manville, 22 East 40th Street, New York City, for your copy.

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FLO-WATCH . . . a simple mechanical flow meter —with unusual accuracy

The **FLO-WATCH** is an inexpensive mechanical meter, designed for use in smaller community water plants which otherwise would have to do without Recording Instruments; and for the less important lines in larger plants.

Features:

1. **Simple, compact, mechanical design with few adjustments.**
2. **Universal mounting—wall, floor, or panel.**
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Bulletin 284 describes this latest Instrument in the list of Builders Iron Foundry Water Works metering and controlling equipment—a copy will be sent upon request, address:

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(*Continued from page 22*)

interruption of the various research, scientific testing, and follow-up activities. The National Board of Fire Underwriters, which contributed to the original cost of the enterprise and under the direction of which it was established and has been maintained, continues its sponsorship.

"**In the past twenty years,** the business world and the public have become economics-conscious and dabble daily in index numbers of all kinds and the paraphernalia of foreign exchange and statistics of economic life. The relativity of economic principle to national psychology baffles the economists themselves, for it can be said truly at one and the same time, for example, that confidence will be best secured by balancing the budget, and by not balancing it, according to public mentality. The economics of a community not economically self-conscious are quite different from those of a people who watch every sign and act accordingly. Thus the common notion that economics should be judged by its ability to forecast (especially to a particular date) is quite fallacious, for the prophecy, if 'true' and believed, must destroy itself, inasmuch as the economic conduct involved in the forecast is different after the forecast from

(*Continued*)

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Lasting Protection for Steel Pipe

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elevated temperatures and cannot be stripped from t… bond between the
coating and the steel is unequalled. Water pipe …
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growth cannot occur on the s…

The rigid technical specifi…
Primer from high quality raw…
quirements:

(a) The adhesi…
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Primer and…
to strip or pr…

(b) A smooth, clear…
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(c) The plate prepar…
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treatment…

Reilly Pipe Enamel Coating on a California Oil Transmission Line.

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4½ inches in length. The deflec-
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mel shall be determined by care-
il Enamel which exhibits the
of the six panels the Enamel
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BENEATH THE SPECIFICATION
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The finished job coated with Reilly Pipe Enamel gives assurance of a job well done . . . the assurance of dependable and permanent protection. Such confidence is founded on the rigidity of Reilly specifications . . . no flow or sag at temperatures approaching 200°F. . . . no chipping, peeling or cracking at sub-zero temperatures as low as minus 20°F. The inherent dependability of Reilly Pipe Enamel merits your attention.

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AMERICAN WATER SOFTENER COMPANY
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ADVERTISING
in this
JOURNAL
means more
BUSINESS

(*Continued from page 26*)

what it would have been before. The paradox is just here, for example: if a people are told that the peak of prices in a commodity will actually be on June 10, they will all so act that they anticipate the date and destroy it. Economics, thoroughly comprehended, can well foretell the effects of a tendency, but hardly ever the precise date or amount of critical events in those effects." So said Sir Josiah Stamp in his Presidential address before the British Association for Advancement of Science (1936).

In a recent address, L. A. Downs, President of the Illinois Central Railroad System, made this reference to the work of C. R. Knowles of this Association—"Improved methods of water treatment and the regular blowing off of boilers on the road and at terminals removes the impurities and prevent scale and corrosion; and so extend the life of boilers, flues, staybolts and other parts. The service life of flues has been doubled—from six to twelve years, on the average—by these methods. The average service life of fire boxes has been lengthened six years or more. Before 1929 we had to rebuild 115 fireboxes a year; since then we have averaged 15 a year."

(*Continued*)

(*Continued from page 30*)

The 75th Congress was only a few hours under way until several pieces of legislation directed toward stream pollution abatement were introduced. Senator Lonergan has presented a bill similar to the one he offered last year and which failed of passage. It would make the creation of water districts and district boards mandatory. The Barkley-Vinson bill, which tends to promote compacts between states, has the active support of an Ohio Valley group centering about Cincinnati.

Members of this Association may well be reminded of the attitude expressed by the Directors at their meeting in January, 1936:

> "It is the judgment of the Board of Directors of the American Water Works Association, if and when legislation is introduced in the Congress of the United States to place the control of the pollution of water under the Federal Government, that the Committee on National Water Policy be authorized to appear before the appropriate Congressional Committee on this subject to advise it of the policy of the American Water Works Association to the effect that, for the present—no further extension of Federal control over streams is desirable, that the Federal Government should restrict its activities in this field to the functions of fact-finding on, and coördination and stimulation of, state and interstate programs, and that the initiation, administration and financing of projects should be reserved for state and inter-state action."

The question of Income Tax payment by municipal water department employees has been again brought into prominence, not only by discussion of the Social Security Act but also by the fact that the test case of W. W. Brush, petitioner, against Commissioner of Internal Revenue, respondent, has recently received authorization from the Supreme Court of the United States to be heard before that court. Mr. Brush's case was the subject of an unfavorable ruling last fall by the U. S. Circuit Court of Appeals (Second Circuit, October term, 1935, No. 246). Steps were immediately taken to carry an appeal to the Supreme Court, with the above mentioned favorable result. There are still hopes that at least partial success may be attained, since in presenting the case before the Supreme Court it is intended to stress to a greater extent the contention that at least that part of the salary attributable to the performance of unquestioned governmental functions should be exempted. Mr. Brush is the chairman of the Association's committee which is following this subject. The other members of the committee are Messrs. W. W. Hurlbut and E. F. Dugger.

(*Continued*)

(*Continued from page 35*)

Asher Atkinson a member of this Association since 1922, has retired as City Engineer of New Brunswick, N. J.

Charles W. Mowry, well known to water works men over the entire country, died on December 19th last. He was manager of the Inspection Department of the Factory Mutual Fire Insurance Companies. He was highly skilled in the design of the sprinkler and tank systems for industrial plants. His intelligent cooperation with the work done in recent years in control of cross connections commended him highly to men particularly interested in the sanitary control of water supplies.

Laurence C. Hough, of the Pitometer Co., died of a heart attack on January 13th, while he was in Savannah. He had been a member of this Association since 1919. During his eighteen years connection with the Pitometer Company he had made or supervised water works surveys in more than 85 cities of the United States and Canada and had made special tests in 50 more cities.

John H. Gregory died at his home in Baltimore on January 18th. He was professor of civil and sanitary engineering at Johns Hopkins University, a member of the board of consultants on the water supply of Baltimore and for many years a consultant to the department of public works of Columbus, Ohio. He had been a member of this Association since 1910 and had rendered distinguished service to the water supply field.

Dr. Wm. P. Mason, an Honorary member and Past President (1910) of this Association, died on January twenty-fifth at his country home in New Hampshire at the age of eighty-three years. He was graduated from Rensselaer Polytechnic Institute in 1874 as a civil engineer. He became an assistant in the Chemistry department the following year. He was the head of the department of chemical engineering at R. P. I. when he retired in 1925. He was not so well known among the younger men of the Association, but those who entered the field of purification control prior to or about the turn of the century remember Mason's "Examination of Water" very well. He studied bacteriology under Pasteur in Paris and was one of the real founders of laboratory control of water supply in America. One of the last landmarks of the days of Welch, Smart and Sedgwick has passed on.

NEWS OF THE FIELD

The American Research Committee on Grounding, an inter-association activity in which The American Water Works Association is a joint sponsor with the Edison Electric Institute, now has its British counterpart. The Institution of Civil Engineers has appointed a "Sub-committee on Earthing to Metal Water-Pipes and Mains." The Journal of the Institution, in its October 1936 issue, states:

"Many cases have arisen where corrosion to water-mains has been attributed to and, in some cases, proved to be due to such earthing, and there have been instances where electric shocks have been incurred during the repair of watermains. While it is generally acknowledged that continuous current causes electrolytic corrosion where it leaves a metal conductor or pipe to earth, there is some doubt about the action of alternating current. In view of the importance of the subject to both electrical engineers and water engineers, a Sub-Committee on Earthing to Metal Water-Pipes and Mains has been set up with the approval and collaboration of the Institution of Electrical Engineers, the Institution of Water Engineers and the Water Associations.

"The following are the terms of reference:

"To explore the problem of possible injury to metal water-pipes and mains through the earthing thereto of electrical installations, particularly in relation to alternating currents, with a view

(a) To investigating the existence and extent of such injury, research being carried out if necessary.

(b) To obtaining mutual agreement on the conditions under which earthing connections to water-pipes and mains might be made, and

(c) To formulating, if necessary, a set of regulations in respect thereof."

Contact, for purpose of exchange of information, is being established between the American and British committees. The A. W. W. A. representatives on the American Committee are finding many interesting examples of the effect of stray currents on water quality. Managers and chemists of water departments, who find themselves puzzled by unaccounted for customer complaints concerning odor or discoloration of their supply will profit by correspondence with Messrs. Cowles or Meyerherm.

The Johns Hopkins School of Engineering celebrated twenty-five years of advanced instruction and research February 19–22. An address which

(Continued)

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Cast Iron, of course, *but* . . . no lead, no pouring, no bell holes to dig. Machined iron-to-iron, flexible joints made with just wrenches —*that's all!*

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JOURNAL
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BUSINESS

(*Continued from page 1*)

had been prepared by John H. Gregory was read and fitting reference made to the loss sustained by the university as well as the engineering profession because of his death. The degree of Doctor of Engineering was conferred upon Abel Wolman.

The Permutit Company has named Daniel J. Saunders its Manager of Industrial Sales.

The Pennsylvania Salt Company announces a new manual on the properties and methods of handling "Perchloron" in water, swimming pool, and sewage treatment. The publication is available upon application to the company's offices at Philadelphia.

The members read the memorandum sent from this office on January 30th. The Secretary's office has direct evidence of that fact, in the form of a growing group of comments on the question raised as to the size of the JOURNAL page. This will serve to acknowledge such comments. They are helpful. At present the response is almost unanimously in support of the present size. Further comments are invited.

(*Continued*)

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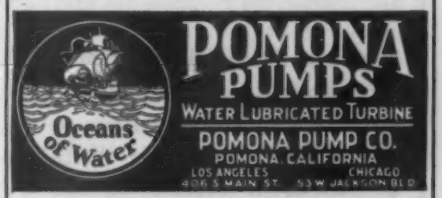

Index to the Proceedings, Journal and Other Publications of The American Water Works Association from the Founding of the Organization. 1881–1933

This book opens the door to an immense store of knowledge covering studies, problems and experiences of hundreds of water works superintendents, engineers, scientific specialists, etc., during the past fifty-three years.

It is well bound in buckram, with stiff covers, and contains 233 pages. The price is $1.50 per copy to members and $2.50 per copy to non-members, postpaid.

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29 W. 39th St., New York, N. Y.

(*Continued from page 5*)

Mr. John N. Ballentine, President of the Neptune Meter Company, left via Los Angeles on March 3rd for an extended tour of the South Pacific and Australia.

A Sanitary and Testing Laboratory has been opened by Mr. Thomas M. Riddick, consulting chemist, at 369 East 149th Street, in New York City. Mr. Riddick was formerly an instructor in Sanitary Engineering at New York University and more recently was in charge of the analytical and testing laboratory of the late Nicholas S. Hill, Jr. Mr. Riddick's new laboratory will specialize in analyses of water, sewage and milk and the testing of fuels, sand and cement.

Parking at hydrants is now permitted "live" taxicabs by a recent order of Mayor La Guardia of New York. The opinion was that if a cab with a driver at the wheel was permitted to park at a hydrant, locked cars would be less likely near a hydrant and in the event of fire the supply would be more accessible to a fireman.

(*Continued*)

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THOMASVILLE, GEORGIA

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It is just as much false economy to set a water meter in the cheapest way as it is to do the plumbing of a house in the cheapest way—

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A water meter set in a Ford Yoke or in a Copperhorn Meter Coupling can be easily removed and replaced without disturbing the service pipe—

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This one fact alone justifies what slight extra cost there may be—

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Straight Line Yokes for shallow meter box or basement settings in horizontal piping

Saves Couplings

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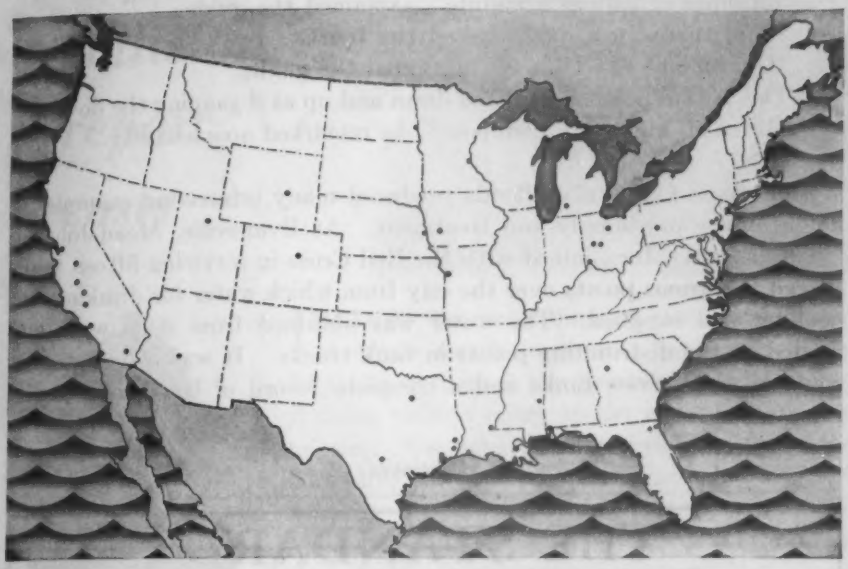
GOOD NEWS
ABOUT SOIL CORROSION



Map showing locations of soil corrosion studies conducted by U. S. Bureau of Standards.

TO PIPE USERS: Exhaustive investigations by the U. S. Bureau of Standards and other independent authorities prove these two significant facts:

1. "Only a small percentage of the soils in the United States are severely corrosive; and probably less than 10 per cent of all underground pipe is in such soils."

2. "In most soils there are definite indications that the rate of corrosion decreases with time."

Guided by these reassuring facts, more and more cities are designing pipe lines to meet specific requirements. Designing with Armco Spiral Welded Pipe, for instance, you can devise a specification that will provide almost any degree of permanence you feel is desirable and practical. Let us help you. The American Rolling Mill Company, Pipe Sales Division, 901 Curtis Street, Middletown, Ohio.

ARMCO

SPIRAL WELDED PIPE

(*Continued from page 10*)

Apropos of Buffalo and the A. W. W. A. Convention (June 7–11) is the story of an English tourist who was on his first visit to Niagara Falls, and a guide was trying to impress him with their magnitude.

"Grand!" suggested the guide, but the visitor did not seem impressed.

"Millions of gallons a minute", explained the guide.

"How many in a day?" asked the tourist.

"Oh, billions and billions", answered the guide.

The visitor looked across and down and up as if gauging the flow.

"Runs all night too, I suppose?" he remarked nonchalantly.

The recent Ohio valley floods produced many interesting examples of emergency water supply and treatment. At Evansville, Mead-Johnson Co. and Servel, Inc., joined with the Red Cross in servicing fifteen tanks placed at various points over the city from which water for drinking and cooking was supplied. The water was obtained from deep wells and hauled to the distributing points in tank trucks. It was chlorinated en route to the service tanks and a complete record of laboratory results maintained.

(*Continued*)

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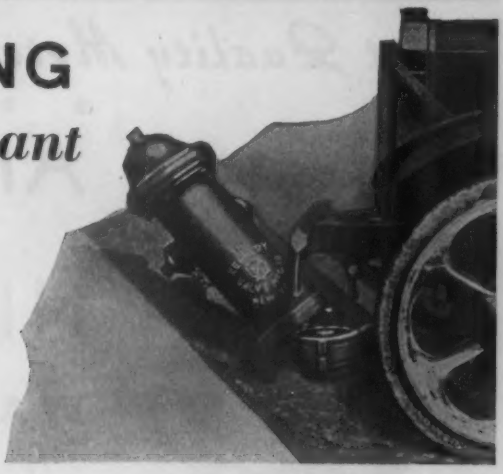

Send for Bulletin

IMPACTS that would demolish other types of fire hydrants merely fracture an inexpensive Safety Breakable Section of the Kennedy SAFETOP Fire Hydrant without injury to the major parts of the hydrant. The water pressure in the main keeps the inlet valve tightly closed so that there is no danger of flooding. No excavating is necessary, nor need the water service in the vicinity of the broken hydrant be shut off while awaiting or making repairs.

The only parts that need be renewed cost $6.00. They can be replaced by one man, with standard tools, in less than half an hour.

This unique design therefore provides the important multiple benefits of (1) minimum interruption to fire hydrant service after breakage, (2) elimination of cost and trouble of excavation, (3) inconsequential cost of hydrant repairs, (4) security from suspension of water service, and (5) protection against serious property damage and personal injuries.

Any style of fire hydrant now installed can be replaced by a Kennedy SAFETOP Fire Hydrant at low cost and without removing the existing hydrant elbow.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

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For Unrivalled Accuracy
WRITE FOR CATALOG

BUFFALO METER CO.
ESTABLISHED 1892 2914 Main Street Buffalo, N. Y.

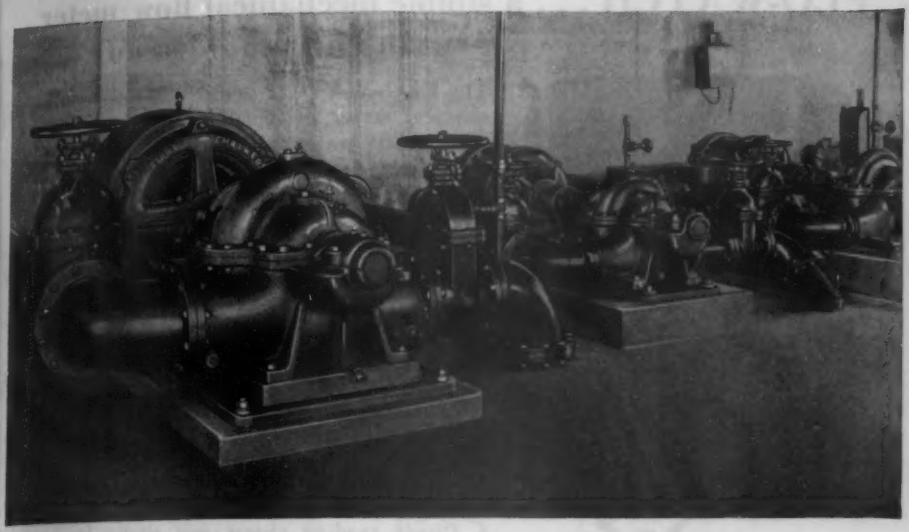
(*Continued from page 14*)

"Chloramination" is a new term appearing in Lt. Col. Harrold's 1935 report to the Metropolitan Water Board (London, Eng.). Its meaning is equivalent to "ammonia-chlorine treatment" as it is expressed in North America. It has the virtues of brevity and precision and is commended as an addition to water treatment terminology.

"It may be of interest to you to know that the Mr. ---- ---- whom you mentioned in your letter is no longer with the local Water Works, and hasn't been for some time. He was ousted from his position to make way for another person, and now the other person is in the way of being ousted to make way for a third individual. We have civil service and the City Manager type of municipal government but actually our municipal government is like no other in existence." This was the news received in reply to an inquiry concerning a man who had formerly been a member of the Association.

Hookworm infection, according to widespread press comment, has been found to be susceptible of transmission via polluted water. Major C. C. Johnston of the U. S. Army traced repeated infestation of a certain battalion

(*Continued*)



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THE large quantity of water which can be delivered by the relatively small centrifugal type of pumping units together with recent improvements in details of design materially lowering the power required for the drive and correspondingly reducing the cost for current, present interesting possibilities in pumping plant rehabilitation or when increased capacity is needed. Where equipment is to be paid for out of earnings, only high grade pumps can be considered and those which have sustained high economy and low maintenance. Allis-Chalmers Combined Centrifugal Pumping Units have long been recognized as having these qualities.

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The **FLO-WATCH** is an inexpensive mechanical meter, designed for use in smaller community water plants which otherwise would have to do without Recording Instruments; and for the less important lines in larger plants.

Features:

1. **Simple, compact, mechanical design with few adjustments.**
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3. **No clocks to wind—electric chart and totalizer drive.**
4. **Totalizer—accurate mechanical integration.**
5. **12-inch charts, having uniform rate spacing.**
6. **Used with either Venturi Tube or orifice plate.**
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AND, IF DESIRED:

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Bulletin 284 describes this latest Instrument in the list of Builders Iron Foundry Water Works metering and controlling equipment—a copy will be sent upon request, address:

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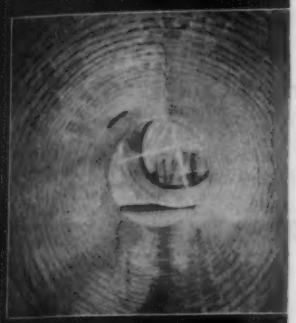
(*Continued from page 22*)

to the use of water from a hookworm polluted source. It is not certain that the discovery is new, since an article by Geo. C. Bunker, abstracted on page 289 of the February JOURNAL, makes reference to possible transmission of several parasitic disorders by water which has not been filtered or sterilized.

A recent survey of what prospective home owners want discloses that 77 percent want a tub shower, 82 percent want a laundry in the basement, 65 percent want air conditioning. Of the accessory conveniences, automatic water heating was first, mechanical refrigeration of food second and a controlled heat oven in the kitchen third. It is of interest to realize how the uses of water and the promotion of more ease in water use loom so large in the American mind. Does the water supply industry appreciate its opportunity?

Justified complaints can be reduced and many of them can be eliminated, if managements will study them sufficiently to determine their underlying causes. The formula for improving customer relations, and also our balance sheet, is for management to authorize the steps required and to see to it that each of the causes is actually followed through and overcome.

(*Continued*)



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. . . Under this slogan the women of America are uniting in the first national campaign to fight cancer and its allies, fear and ignorance—uniting in a mighty effort to save human life. Cancer can be cured if discovered in time. Perhaps as many as half the 140,000 persons who die of it each year can be saved by the spread of truth and knowledge.

March with us in this great Crusade!

WOMEN'S FIELD ARMY

American Society for the Control of Cancer
1250 Sixth Avenue, New York City

WHAT YOU CAN DO TO HELP. *Enlist in the Women's Field Army. Send $1 to the American Society for the Control of Cancer today. Seventy cents of your dollar will be spent by your State Division in cancer control work.*

(*Continued from page 26*)

The collection department is one of the major custodians of the company's reputation. In no other activity is the human equation more important in influencing public relations. A lenient collection policy, administered at times with poor judgment, may cause more ill-will in a community than would be caused by a strict policy, tempered with reason, which is administered properly.

The Collection Department of a certain water department recently received the following:
Gentlemen: Enclosed please find money order in amount $2.87 with which to balance account . . . so please do not disturb Mrs. ---- ------ our guarantor in this matter—as she has been dead and buried for seven months.

Water use and waste was discussed at the 1936 meeting of the British Water Works Association. The remarks of Mr. J. Bowman of Edinburgh were informative when he stated that he believed that in due course the consumption of water would rise to between 40 and 50 gallons per head

(*Continued*)

(Continued from page 30)

per day. In Edinburgh it was 42 gallons, in Dundee 36 and in Perth 50. If they could reduce their consumption to 25 gallons they would be in a very happy position as far as water resources were concerned in dry weather. In the slum areas of Edinburgh the figure was 9 gallons, but on the new housing estates it went up to 20 and later to 30. In other places such as residential properties the consumption increased to 60 or 70. He did not agree that such water was wasted. It was simply because people were using water on a higher standard than their ancestors, and he thought that as time went on all communities must be prepared to provide for a consumption of not less than 40 to 50 gallons per head per day. In London the consumption was 36 gallons, in Scotland from 36 to 70 and in America 80. He thought a consumption of 25 gallons pointed to half the population being housed in conditions that were not sanitary. Fifty percent of people in Edinburgh were living in houses with no baths, 25 percent in Dundee and 60 percent in Perth. In Scotland, although they were high consumers of water, they were not necessarily wasters of water. Mr. H. Avery, of Plymouth, said the principal factor in water consumption was still the number of people supplied rather than any change in the habits. The economic position of the average rate-payer did not permit him to enjoy the use of water as he would like. With a shorter working week and cheaper electricity there would be a greater use of baths by the working classes, consequently the supply of water in the future will be governed by the change of habits of the people as distinct from the number supplied.

A report on the use of aluminum cooking utensils in relation to health, issued by the Ministry of Health (British) and entitled 'Aluminium in Food', shows "that the amount of aluminium which may gain access to food from aluminium vessels under different conditions is very small Common sense must be used in cooking in aluminium. Strongly alkaline materials, such as soda, will attack it, as also will strong acids, but the pure metal seems to be remarkably resistant to corrosion by acid foods. In general the amount taken up by foods in this way is far less than the amount which would be introduced into bread by the use of alum baking powder. The conclusion is reached that there is no convincing evidence that aluminium, in the amounts in which it is likely to be consumed as a result of using aluminium utensils, has a harmful effect on the ordinary consumer, but that the use of alum baking powder is undesirable."

(Continued)

Dangerous Waters!

WHEN floods bring the threat of polluted water supplies and of water-borne disease, HTH proves itself an invaluable ally to water works and health officials. With HTH, emergency hypochlorination can be applied quickly, on the spot, wherever pollution is found. A highly concentrated chlorine carrier, containing 70% of available chlorine, quickly soluble in water, HTH can be transported to the job and put to work before a dangerous situation has time to develop.

Then there is the aftermath of flood conditions, as receding waters leave a seemingly hopeless task of cleaning up and disinfecting flooded areas and buildings of every kind. Here again health authorities find HTH of invaluable assistance in restoring sanitary conditions in scores of places where a less concentrated, less mobile or less soluble source of chlorine cannot serve as effectively.

Fortunately, floods do not strike frequently or the average community nor do they strike so quickly as to find local officials wholly unprepared. But there are day-to-day emergencies, too, which require prompt and effective chlorination—broken water mains, an abnormal water load due to a serious fire, polluted wells, failure of a chlorinator, an interruption in the power supply—just the sort of jobs for which HTH is made to order.

No wonder that so many experienced water works men keep an ample supply of HTH always on hand, not only as an important measure of preparedness for every sort of emergency, but also because they find it so useful in scores of every-day sanitation jobs! Write or wire us for full information and nearest available stock.

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Liquid Chlorine . . . HTH and HTH-15 . . . Soda Ash . . . Caustic Soda . . . Bleaching Powder . . . Bicarbonate of Soda
Ammonia, Anhydrous and Aqua . . . Pll-Plus (Fused Alkali) . . . Solid Carbon Dioxide

BE PREPARED WITH HTH FOR ANY EMERGENCY!

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CENTRIFUGAL PUMPS

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WATER METERS

A complete line of water meters of every type is manufactured by Worthington-Gamon Meter Company, a subsidiary of Worthington Pump and Machinery Corporation.

Complete descriptive literature available

WORTHINGTON PUMP AND MACHINERY CORPORATION
WORTHINGTON-GAMON METER COMPANY
General Offices: HARRISON, NEW JERSEY District Offices and Representatives in Principal Cities

A-3887

(*Continued from page 35*)

The Activated Alum Corporation is building a new chemical plant in the Curtis Bay Section of Baltimore. The new office address is 1605 Mercantile Trust Building, Baltimore, where Fred Stuart may be found when he is not in the field promoting the use of activated alum.

Mr. Herbert N. Eaton, director of the National Hydraulic Laboratory of the U. S. Bureau of Standards at Washington, D. C. advises that the laboratory is giving increased attention to its project for the study of plumbing fixtures from a sanitary viewpoint. In particular a study is being made of the conditions under which vaccua may occur in the main water supply piping of large buildings and of the means which may be taken to prevent such occurrences, such as by the use of vacuum breakers, and similar devices. A bulletin on siphon breakers will be issued shortly.

Contamination of water during wartime gas attacks is not a question which has been given much consideration in the U. S. But in handbook No. 4 of the Air Raid Precaution Series (British) is found the following: "Water dissolves only very little mustard gas, and by long contact slowly destroys it by hydrolysis. Large volumes of water such as reservoirs will not become contaminated to any significant extent, and no danger to filtered supplies need be feared. The possibility of contamination by "lewisite" raises a different problem. Lewisite is fairly rapidly destroyed by water, ... and bears poisonous arsenical compounds therein. While water thus affected would have no blistering effect, it might contain a dangerous quantity of arsenic. Reservoirs supplying large undertakings would be too large to be appreciably affected; but in the even of a large lewisite bomb falling on a small reservoir (say, less than 3,000,000 gallons) the water should be tested for arsenic before being supplied for drinking."

John Chambers of Louisville, for the past sixteen years Chief Engineer and Superintendent of his city's water department, died on January 20th. He was well known to the older members of the Association, a member of the Board of Trustees in 1929 and 1930, and for many years a familiar figure at the annual conventions.

Samuel D. Poarch of Olean, N. Y. died February 14th after a brief illness. He graduated from the University of Iowa in 1927, and was an instructor-assistant to Prof. J. J. Hinman until 1929. He became a member of this Association in 1930 and was General Superintendent of the Olean Water Department at the time of his death.

The Supreme Court, on March 15th, ruled in favor of Wm. W. Brush to the effect that municipal water department employees are not subject to the Federal income tax.

The abstract section of the JOURNAL is entitled to some critical study by the members of the Association. There are two questions which should be asked. What can be done to improve the abstract section? Shall it be continued? In 1936, the JOURNAL included 1767 pages of papers and 271 pages of abstracts. The total of 2038 pages represents about as much material as the Association can afford to publish. The allotment of relative space to the text and abstract sections can be varied but expressions of opinion from the field are needed as a guide to future action.

Since the first of the year, abstracts have been classified and grouped under headings. An effort has been made to bring to the front items of general interest. This in turn has resulted in relegating to the later pages items which are of interest to water purification and laboratory men. It has been hoped that water works superintendents and heads of maintenance divisions of water works properties would find use for the abstract section. We know that the laboratory workers have available to them other abstract journals. We also know that they are a persistent lot and will keep turning the JOURNAL pages until they find items of interest to them. How to appraise the interest of the superintendents is a problem. Do they read the abstracts? Do they want more of them? What does the membership as a whole prefer? More pages of papers and less abstracts? The status quo? Suppose you tell us what you think.

Gadget displays are becoming an interesting part of many section meetings. At the recent sessions of the Indiana section, first prize was won by the combination of the needle holder and diaphragm box from a talking machine with the discarded tubes and ear pieces of a doctor's stethoscope. It is a leak detector, and, with all apologies to Professor Lucifer Butts, Stoopnagle and Budd, etc., it works. The record needle is held against the water pipe and the stethoscope ear pieces properly draped about the user's head. If there is a leak, it makes a decided impression upon the user's ears.

Second prize went to a rock grabber, designed to remove stones from a curb stop box. Every service man who has had to undo the result of a small boy's energy on a busy afternoon, would appreciate the device that one Indiana man had made for the use of his department. It looked like a dentist tool feels, was provided with a hinged pair of spoons and accessory parts all designed to assist in extracting the rocks tucked in the stop box by some diligent youngster.

At another section, not so long ago, a laboratory man's gadget consisted of strips of old inner tubes from auto tires, cut across to make 1 inch stout bands. These were stretched around sample bottles in such a way as to prevent rattle and breakage. It was a simple and efficient device, but it took a "gadget" contest to bring it out into the public eye.

(Continued)

UNIVERSAL PIPE

Cast Iron, of course, *but* . . . no lead, no pouring, no bell holes to dig. Machined iron-to-iron, flexible joints made with just wrenches —*that's all!*

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FOR WATER SOFTENING AND IRON REMOVAL

Zeolite Chemical Company, 144 Cedar Street, New York

(*Continued from page 1*)

Correction must be made of certain details of the article by L. H. Enslow in the January 1937 JOURNAL. The publications "Lime—its use in Water and Sewage Treatment" (The National Lime Association) and "Handbook on Pumps" (Worthington Pump Co.) are out of print. The publication "Water Supply and Treatment" (National Lime Association) and the "Plumbing Code" (Bureau of Standards) are not available for free distribution. The U. S. G. S. water supply paper # 658, "The Industrial Utility of Public Water Supplies in the U. S. (1932)" should be included in the list. It is priced at 15 cents and may be obtained from the Superintendent of Documents, Washington, D. C.

A useful little booklet entitled "Questions and Answers on Boiler Feed Water Conditioning," prepared by J. F. Barkley, has been made available by the U. S. Bureau of Mines and may be purchased from the Superintendent of Documents, Washington, D. C. at 20 cents a copy. In 120 pages it attempts to give information about boiler-feed water to boiler operators who have not studied chemistry.

(*Continued*)

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It is just as much false economy to set a water meter in the cheapest way as it is to do the plumbing of a house in the cheapest way—

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A water meter set in a Ford Yoke or in a Copperhorn Meter Coupling can be easily removed and replaced without disturbing the service pipe—

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This one fact alone justifies what slight extra cost there may be—

THE FORD METER BOX CO.
Wabash, Ind.
Water Meter Setting and Testing Equipment

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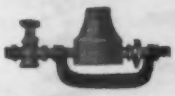


Straight Line Yokes for shallow meter box or basement settings in horizontal piping

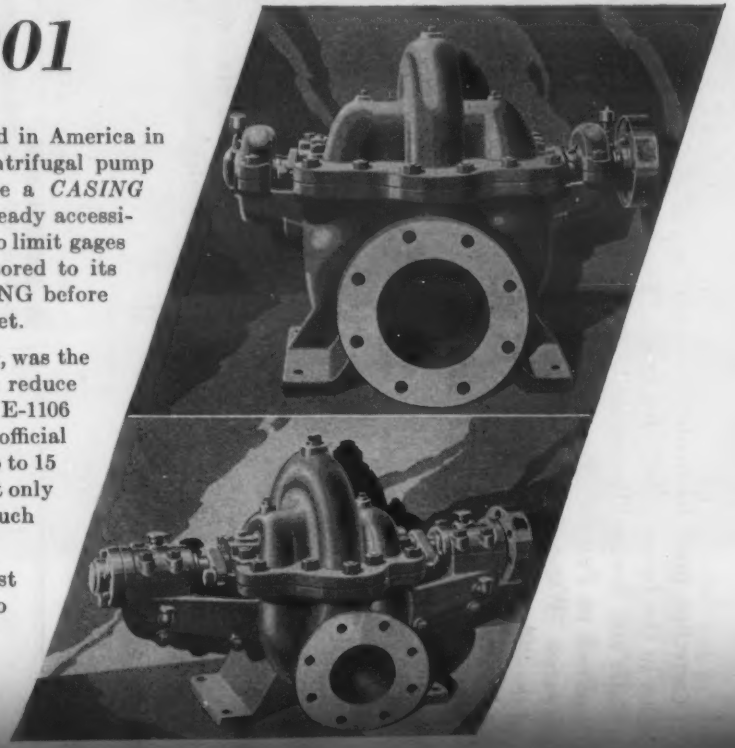
Saves Couplings

Saves Fittings

Ford Copperhorn Meter Coupling

DE LAVAL CENTRIFUGAL PUMPS

Leaders since 1901



THE DE LAVAL CENTRIFUGAL PUMP, as first introduced in America in 1901, was revolutionary and initiated new standards in centrifugal pump design. Among its novel and distinctive characteristics were a *CASING* split horizontally in the plane of the axis of the shaft, providing ready accessibility to internal parts; *RENEWABLE WEARING PARTS* made to limit gages to be interchangeable, so that the pump could at small cost be restored to its original condition after wear; and a uniform practice of TESTING before shipment from the Works, to insure that all guarantees would be met.

A notable improvement, of particularly great value to the user, was the introduction of DE LAVAL LABYRINTH WEARING RINGS to reduce leakage from discharge to suction. Our recently published Leaflet E-1106 (sent upon request) presents results of public acceptance tests and official records of efficiency of pumps operated continuously for periods up to 15 years, which demonstrate that these De Laval Labyrinth Rings not only enable pumps to show high efficiencies initially, but to maintain such high efficiencies with little or no expense for pump maintenance.

Inasmuch as the cumulative bills for power soon exceed the first cost of a pump, this matter deserves careful study of pump users, who should all send for and familiarize themselves with Leaflet E-1160.

DE LAVAL STEAM TURBINE COMPANY

Trenton, New Jersey

(*Continued from page 7*)

The home interests of wives of A. W. W. A. members are not lacking in versatility as is demonstrated by the fact that the winning entries of Mrs. S. F. Newkirk, Jr. and of Mrs. H. Seaver Jones in the 1937 New York Flower Show were the subjects of illustration in the New York Herald Tribune.

Mr. Leonard Peckitt, President of the Warren Foundry and Pipe Corp., was elected on March third to the Board of Directors of the American Standards Association.

"Lake Ben Morrow" is the latest addition to the list of major structures named for men in the field. On February 17th, the city council of Portland, Oregon, unanimously voted to name the eleven billion gallon artificial lake which impounds that city's water supply after the man who

(*Continued*)

Why your community
Should have SAFETOPS

MINIMUM pressure loss provided by extra large standpipe and smooth easy elbow and nozzle curves.
Maximum reliability assured by simple, straight-line operating mechanism and special long-wearing valve and gasket materials.
Minimum repair expense secured by the unique Safety Breakable Section. When struck by an impact which *no* hydrant could resist, this section parts cleanly, protecting the major and expensive portions of the hydrant from damage. The hydrant can be returned to service by one man, within half an hour, without excavating or shutting off the water pressure, and with parts costing only $6.00.
Maximum convenience obtained by ease of adjustment of working parts, nozzle positions, lubrication, etc.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

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FIRE HYDRANT

Raised and Lowered 3 Times

WITHOUT BREAKING OR LEAKING

HERE IS POSITIVE PROOF of Armco Spiral Welded Pipe's ability to withstand severe punishment. *Filled with water,* maintained at a pressure of 50 pounds, this 160-foot section of Armco pipe weighed about 15 tons.

Although one end was raised and lowered three times to a height of *14 feet,* there was no rupturing of the metal—no sign of leakage at any point in the tightly welded section.

Your pipe lines may never be called upon to withstand conditions as severe as these. Just the same, it is reassuring to know that Armco Spiral Welded Pipe provides a *wide margin of safety* against forces that often destroy other types of pipe lines. To obtain complete information address The American Rolling Mill Company, Pipe Sales Division, 902 Curtis Street, Middletown, Ohio.

ARMCO SPIRAL WELDED PIPE

No Crane valve becomes a regular catalog item until it has passed every test that Crane engineers devise.

No Crane valve becomes a regular Crane catalog item until its records "on the job" show that it has more than enough to do the work for which it is recommended.

No valve or fitting leaves the Crane plant until it has passed a long series of routine tests.

That is why, month after month, "complaints, zero" is the only comment noted in so many columns on Crane department reports.

For most "new" valve problems Crane has solutions proved and ready for use. Look to your Crane No. 52 Catalog for the details regarding 8,000 items, tested in the laboratory and on the job. Use it whenever you need valves, fittings, pipe or accessories. CranEquip for satisfaction.

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plied in the next few days.

BASIC PRINCIPLES OF PIPING

CHICAGO, ILL., Feb. 17—The designing of piping for your pumping station services requires specialized engineering knowledge. Crane Co. is always ready to give you the benefit of their long experience in these problems.

Basically there are six major principles to be observed in piping layouts. Each opens the way to specialized study. These are:

1. Adequate strength and proper application of valves, fittings and piping. A high safety factor based on the physical characteristics of the materials should be provided.

2. Flexibility as insurance against building up dangerous expansion and contraction strains.

3. Proper and adequate support and anchorage to carry maximum load safely and to prevent vibration.

4. Properly selected pipe line joints for the service requirement.

5. Complete control through valves of proper size, design, material and workmanship installed at essential points.

6. Proper and complete drainage of certain lines.

You'll find a very large body of helpful piping data in your Crane No. 52 Catalog. Use it as a handy, trustworthy companion in planning piping. Use it also to order CranEquipment for your plant. CranEquipping is the reliable solution to piping problems.

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(BRONZE CASE)
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(IRON CASE)
WATER METERS
For Unrivalled Accuracy
WRITE FOR CATALOG

BUFFALO METER CO.
ESTABLISHED 1892 2914 Main Street Buffalo, N. Y.

(*Continued from page 11*)

who has been in the water bureau for 25 years and its general manager since 1925. Now he joins the list of distinguished members of this Association whose service to their community is given fitting and permanent recognition.

The relative importance of the factors for selecting coal has been evaluated in a series of charts to guide the consumer in buying coal for his particular needs. These charts have just been published in "Factors Recommended for Consideration in the Selection of Coal," which was prepared under the administrative supervision of the American Society for Testing Materials with the cooperation of the National Association of Purchasing Agents. Copies are available at $1.00 each from the American Standards Association, 29 West 39th Street, New York, N. Y.

The Pittsburgh-Des Moines Steel Co. of Pittsburgh, Penna., has just released its new, up to date elevated steel water tank bulletin (No. 101). The booklet contains eighteen pages of illustrations and information for efficient water storage in elevated steel tanks. To obtain a copy of the bulletin, address the Pittsburgh-Des Moines Steel Co. at 3498 Neville Island, Pittsburgh, Penna.

(*Continued*)

A Branch Connection While the Water Flows

QUICKLY, easily, safely, a 30" branch connection can be cut into a 30" or larger main by the use of a Smith Tapping Machine while the water in the main flows merrily along under its usual full head of pressure.

Shut-downs are avoided. They are unnecessary. Expense is saved. Danger is avoided. Health is protected.

This machine is power-operated. It uses an air-motor which supplies a smooth, steady flow of power which enables it to cut through the hardest main in less than an hour.

Other sizes of Smith Tapping Machines will make branch connections from 2" to 42" into any size mains not smaller in diameter than the connection desired.

Smith Tapping Machines are standard equipment today in the water and gas fields.

Send for full details

SMITH
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The A. P. Smith Manufacturing Company
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Smith Tapping Machines—Tapping Sleeves and Valves—O'Brien Hydrants—Valve-Inserting Machines—Removable Plugs, Pipe Cutting Machines—Corporation Tapping Machines—Gas Tee-Inserting Machines—Corporation Cocks—Federal Water Meters.

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TO WATER WORKS DESIGNERS.

BUILDERS IRON FOUNDRY manufactures the following equipment for water works and filtration plants and offers with it the experience of 40 years of specialization in metering and controlling.

Venturi Meters for Main Pipe Lines Acknowledged to be the accurate and reliable means of measuring the flow through large and small pipe lines.
Venturi Rate-of-Flow Controllers Installed in the filter effluent line, they maintain a constant rate of flow through the filter.
Builders Rate of Flow and Loss-of-Head Gauges Recording and indicating gauges for mounting on operating table or separate stand. Standard designs or special to harmonize with plant design.
Venturi Manual Master and Clear Well Master Controllers Rate of flow through entire group of filters set manually from central point, or controlled automatically by level of water in clear well.
Chronoflo Meters Bring in records of flow, level, pressure, temperature, weight, or position from any distance to points where such information best serves operating and supervising engineers.
Registers and Recorders for Open Flumes Additional distant rate indicators, if desired.
Chemical Feeders Chlor-O-Feeders for hypo-chlorinating water supplies; Tret-O-Units for feeding solutions to control pH condition of water; to retard algae growth; for slime control; and similar services.

Your inquiries regarding any of this equipment will receive careful attention.

BUILDERS IRON FOUNDRY 9 CODDING STREET PROVIDENCE, R. I.

(*Continued from page 18*)

Mr. Ben F. Tippins, formerly Superintendent of Water Works and Sewage Disposal at Daytona Beach, Fla., has been secured for the position of Plant Superintendent of the new Activated Alum plant at Curtis Bay, Baltimore, Md., effective March 15th. Of interest to the water works profession in general, it was Tippins who first used powdered Activated Carbon in the pre-treatment at a softening plant for odor control. A charter member and past Director of the Florida Section of the American Water Works Association, Tippins comes to Activated Alum Corp. as a valuable man thoroughly versed in practical water works operating problems. Activated Alum's new plant will be placed into production April 15th.

The American Society for Testing Materials, as of January 1st, 1937, issued a revised index of Standards and Tentative Standards. It includes 796 standards and is of use to anyone wishing to ascertain whether the Society has issued standard or tentative specifications, test methods or definitions. Copies will be furnished without charge on written request to A. S. T. M. headquarters, 260 S. Broad St., Philadelphia, Pa.

(*Continued*)

S

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PREVENT WEAR AND CUTTING of rods, plungers and shafts by using
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on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.
Why not use it in your plant and benefit thereby?
MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

ADVERTISING
in this
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means more
BUSINESS

(*Continued from page 22*)

Water Department Purchasing Agents who use U. S. Federal Specifications will have an interest in the following list of new material:

Bases, Metal; (for) Plaster and Stucco Construction QQ-B-10 lb

Cable and wire; rubber-insulated, building type superaging-grade (0 to 5,000-volt service) J-C-106 Amendment 2

Floor Covering; Rubber, Sheet ZZ-F-461

Gasoline; Motor, United States Government VV-G-101a

Lamps; Electric, Incandescent, Large, Tungsten-Filament W-L-101b Amendment 1

Motor Fuel V VV-M-571a

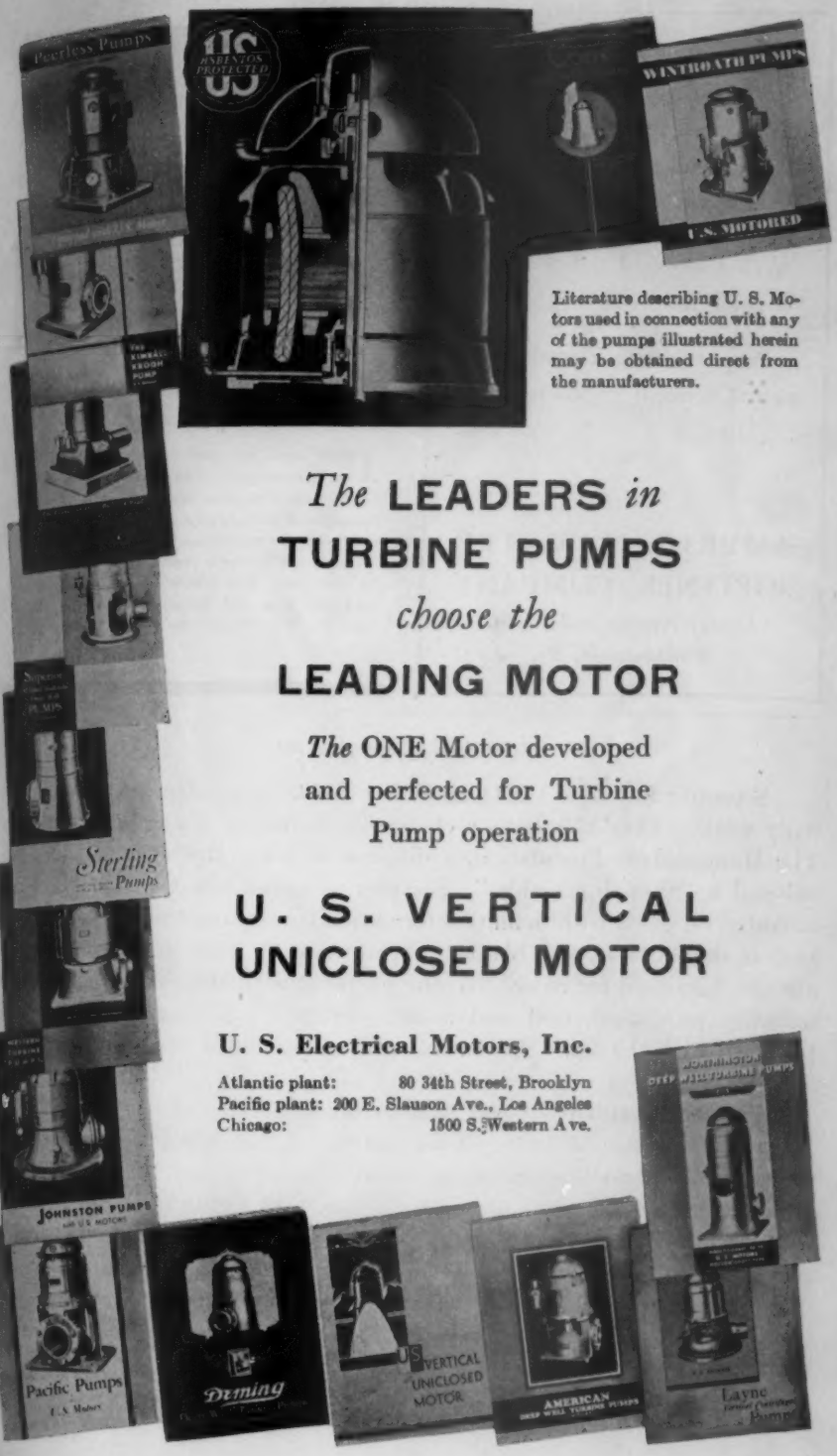
Paint; Titanium-Zinc and Titanium-Zinc-Lead, Outside, Ready-Mixed, White TT-P-101a

Paints; oil, interior, eggshell-flat-finish, ready mixed and semipaste, light-tints and white TT-P-51 Amendment 2

Copies at 5 cents each may be obtained from the Superintendent of Documents, Government Printing Office.

Rainfall in England in the latter half of January, while not so excessive as in the Ohio River valley, was materially above normal. The Thames valley experienced the wettest January since records became available in 1881 which resulted in widespread flooding in that area.

(*Continued*)



Literature describing U. S. Motors used in connection with any of the pumps illustrated herein may be obtained direct from the manufacturers.

The **LEADERS** *in*
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U. S. VERTICAL UNICLOSED MOTOR

U. S. Electrical Motors, Inc.

Atlantic plant: 80 34th Street, Brooklyn
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Chicago: 1500 S. Western Ave.

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WATER FILTERS
WATER SOFTENERS

Proportionate Electro-Magnetic Chemical feeders for feeding lime, acid, alum, soda ash, etc.

AMERICAN WATER SOFTENER COMPANY
Lehigh Avenue and 4th St.
Philadelphia, Pa.

ACIPCO MONO-CAST CENTRIFUGAL PIPE

THIS crew has just finished a joint in a main composed of 36" Acipco Mono-Cast Centrifugal Pipe laid under 10 to 15 feet of backfill and in highly corrosive soil—an installation which emphasizes this pipe's native ruggedness and inherent resistance to destruction by corrosion. For Literature on high quality cast iron pipe and fittings address American Cast Iron Pipe Co., Birmingham, Ala.

(*Continued from page 26*)

Scientific Buying is the thing Water Works men often discuss in their daily work. They now have a chance to encourage it among the ladies. The Homemakers Foundation, a division of Sears Roebuck Co. has developed a "Shopping Guide." Samples of various textile materials are mounted on cards with definite information concerning the characteristics that it should have as a blanket, sheet, dress or what wish you. Cards are also furnished for record keeping purposes with spaces for date, brand quantity purchased, cost and results obtained. A magnifying glass is provided with the set. The entire outfit is assembled in a filing box.

Former President Hoover said before a meeting of the A.S.M.E. in New York on Dec. 2, 1936: "I am convinced that when we fully understand the economic history of the twenties we shall find that the debacle which terminated the end of another apparently highly prosperous period was largely contributed to by a failure of industry to pass its improvements on to the customer. I leave that subject for the moment with this one word: that we are headed in the same direction again today unless we can bring the intelligence and courage of the engineer into industrial statesmanship."

(*Continued*)

(*Continued from page 30*)

More than four times as much water is used per day by the iron and steel industry when operations are at full capacity as is consumed daily in all five boroughs of New York City, the American Iron and Steel Institute has calculated. It is estimated that a total of approximately four billion gallons of water per day is consumed by iron and steel plants operating at capacity. By comparison, the highest daily average consumption of water on record for the five boroughs of New York City was 985,300,000 gallons per day in 1930. The annual consumption of water by the steel industry is estimated at one trillion, 460 billion gallons. This is more than the storage capacity of any of the great dams of the world with the single exception of the great Boulder Dam, which can store nearly ten trillion gallons of water. Approximately 45 per cent of the water needed by the industry is used to make steam, while an additional 29 per cent is used in steel works to cool furnace doors and rolls, operate hydraulic machinery and wash away the scale which forms when hot steel is rolled. About 20 per cent of the volume of water consumed is used to cool the giant blast furnaces which reduce iron ore to metallic iron. The operation of quenching the white-hot coke as it comes from the coke oven requires about 6 per cent of the water consumed. Less than one-third of one per cent is used for sewage purposes.

Approximately 60,000 abstracts are now published each year by Chemical Abstracts and are gathered together from 2808 periodicals printed in 28 languages. The Key to Library Files, which has been a feature of earlier like lists issued by Chemical Abstracts, has been brought up to date by the Research Information Service of the National Research Council Washington, D. C. This useful key is a most effective link in bridging the gap between abstracts and original papers. In addition to the common interlibrary lending practice, many libraries are now equipped to furnish photoprints and translations and a few are prepared to furnish filmstats. The list provides information as to the libraries which are ready to do these things. The recent introduction of the filmstat method of distributing printed information, which is inexpensive, promises to be a strong aid in making cooperation among scientists by publication generally effective. Paper-bound reprints of the list are available and copies can be obtained by writing to Chemical Abstracts, The Ohio State University, Columbus, Ohio. The price is $1.00 per copy.

(*Continued*)

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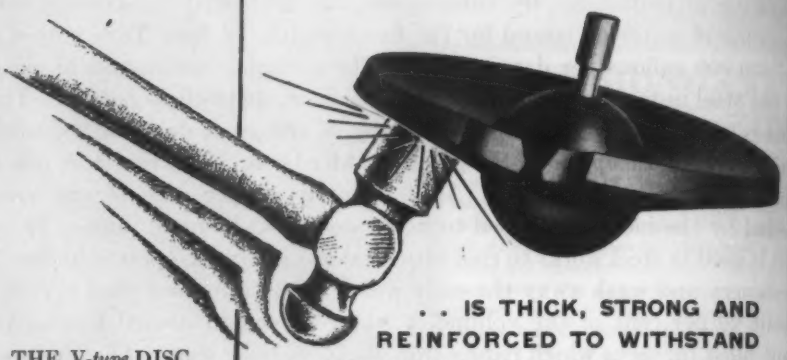
THE NASH V-*type* DISC



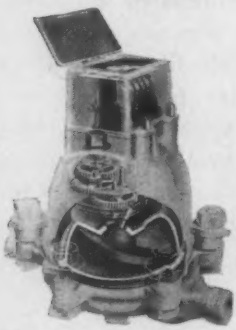
. . IS THICK, STRONG AND REINFORCED TO WITHSTAND MORE THAN 700 BLOWS A MINUTE

THE V-*type* DISC

Stronger for longer life

Larger for fewer motions and less wear

And with a measuring motion as free from friction as the nutation of a top



The L. H. Nash Water Meter

The losses in water revenue and the expense of time-consuming replacements of measuring discs that snap either at the first overload, or during periods of sustained operation at capacity, are seldom found in the service records of L. H. Nash Water Meters.

For the V-Type Disc of this rugged meter is thicker and stronger . . . yet is reinforced, too, as an added factor of safety to successfully withstand the rapid hammer-like blows caused by rapid nutation at full flow . . . blows that occur in disc meters despite every refinement in design.

And the stronger disc of the L. H. Nash Meter is only one of the many advanced features which result in continued accuracy of measurement . . . with the least trouble . . . at the lowest overall cost.

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THE MORSE ALL-STEEL FILTER PLANT

The Morse Filter Plant is modern, efficient, economical. Built in a series of concentric circles, it forms a compact unit. Every part is accessible for inspection or repair. Constructed of steel throughout, seepage and leakage are eliminated. Designs range from 250,000 gpd to 30,000,000 gpd. Write for leaflet describing this modern plant.

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BIRMINGHAM.....P. O. Box 277
SAN FRANCISCO.....Rialto Bldg.
NEW YORK.....165 Broadway Bldg.

(*Continued from page 35*)

Mayor LaGuardia of New York City officially inaugurated the construction work on the city's $273,000,000 Delaware River supply project on March 24th, when he set off a blast for a shaft on the aqueduct line in the town of Gardiner, Ulster County, N. Y.

The next biennial revision of the National Electrical Code is scheduled for 1937. The recognition in this code of uninsulated grounded conductors for circuits within buildings, as proposed by certain groups represented in the sectional committee, and vigorously opposed by groups both of and without the committee organization, will not be advanced, it is reported, until the American Research Committee on Grounding releases its findings on this fundamental matter. The American Research Committee on Grounding is a committee sponsored jointly by the American Water Works Association and the Edison Electric Institute. It is a fact finding committee which is endeavoring to determine the answer to the serious questions which have been raised relative to present and proposed practices in the grounding of electrical circuits on water pipes. American Water Works Association representatives on this committee are M. W. Cowles

(*Continued*)

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
29 W. 39th Street, New York, N. Y.

Date:.....

.....hereby make application for.....Membership
(I or We) (Active, Corporate or Associate)
in the American Water Works Association, and enclose herewith the sum of

$.....the required initiation fee* and one year's dues in advance.

Name.....

Title or Business.....

Address.....

.....

.....

Business or Professional Experience.....

.....

.....

.....

.....

ARTICLE I OF BY-LAWS

Section 3. An Active Member shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Initiation Fee, $5.00; Annual Dues, $10.00.)

Section 4. A Corporate Member shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Initiation Fee, $10.00; Annual Dues, $15.00.)

Section 5. An Associate Member shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Initiation Fee, $10.00; Annual Dues, $25.00.)

Membership in the Association carries also membership in its Local Sections and National Divisions and includes the Journal a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies

* *Initiation Fee Waived During 1937.*

(*Continued from page 38*)

and C. F. Meyerherm. Mr. Meyerherm is also this Association's representative on the sub-committee on grounding of the committee in charge of the preparation of the National Electrical Code.

Heavy water has had a lot of publicity in recent years. Dr. J. F. Kendall of the University of Edinburgh (Scotland) in an interview in the New York Herald Tribune on March 30th, adds to the list by the statement that "elderly persons will soon be able to add ten years or more to their lives by drinking heavy water." The theory is that it would slow their functional processes without impairing their faculties—they would live only half as fast as those drinking ordinary water. Unfortunately, the doctor admits, there is very little heavy water, it must be synthesized and costs too much for anyone other than a multi-millionaire to use it even for drinking purposes.

"Unless popular government can make provisions for expert administration far beyond our present accomplishments it will, in the long run, fail to be a practical success and will ultimately succumb to the appeal of intoxicating philosophies." These are words of President Dodds of Princeton before an assembly at the University of Virginia. "In the United States we have expanded the scope of governmental activities beyond our ability to resolve the administrative difficulties as we have moved along. Government in this age is no theater for amateur actors. We have need of the experience, the balanced judgment, the realistic view to artless cure-alls which long familiarity with public administration alone can give."

James E. Williamson, who will be remembered by many of the older members of the Association as Superintendent of the New York Continental Jewell Filtration Company, died suddenly on March 8th. He was one of the group of men who early in the century translated the research of men such as Fuller and Whipple into practice in communities where water treatment was needed. In recent years he had been in private consulting practice in New York.

Edward E. Johnson of St. Paul, the head of a firm that has held Associate Membership in this Association since 1922, died early this month at the age of seventy-three. He had long been active in the middle northwest in well water supply development.

NEWS OF THE FIELD

Bringing the Association and its Section activities close to the men in the field is one of our major problems. The annual convention is naturally our top meeting. The various Section meetings are next and they are mighty important cogs in the A. W. W. A. mechanism.

Some of the Sections have gone a step further and are conducting each year a series of one day sessions in various parts of their territory. Such an activity brings together in a unified effort the Engineering Staff of the state university, the State Sanitary Engineer and the A. W. W. A. Section. The program gets right down to cases and the speaker-round table combination gets the operators on their feet talking over their problems. One Section is now starting its third annual series of meetings—this time with six regional programs. A professor from the Engineering School will give popular talks on water works machinery, the State Board of Health Sanitary Engineering staff will carry on some field demonstrations and members of the Section will lead round table discussions. There is a lot of value in such a program and it is hoped that many Sections will see its merits and give it a trial.

Automatic start-and-stop control, combined with automatic loading and unloading, can now be obtained without additional equipment on motor-driven single-horizontal compressors, by using the magnetic unloader introduced by Worthington Pump and Machinery Corporation, Harrison, N. J. No extra piping, valves or other devices are required. This device operates on standard electric equipment and can be installed wherever a conventional automatic starter is used for controlling the compressor motor. The only other provision necessary is a pressure switch to operate a pilot circuit. The pressure switch control is transferred electrically from the motor starter to the magnetic unloader, and either position may be selected at will. If connected to the motor starter, the compressor starts and stops on the demand for air. When connected to the magnetic unloader, the compressor runs continuously and simply loads and unloads depending upon whether or not air is needed. If desired, the cooling water supply can also be automatically controlled.

Stream Pollution Control was brought a bit closer by the passage of the Vinson Bill (HR 2711) by the House of Representatives in mid-April. This legislation is of the type supported by Mr. Abel Wolman who appeared before the house committee as a representative of the American Water Works Association. The committee report which recommended to the House that the bill be passed stated in part "There are two major points involved in the bill: (1) A comprehensive study of the problem of the pollution of navigable waters from a national viewpoint to determine what

(Continued)

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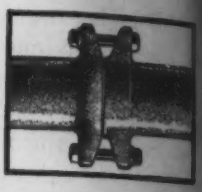
LAID WITH JUST WRENCHES



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Zeolite Chemical Company, 144 Cedar Street, New York

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

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BRANCHES

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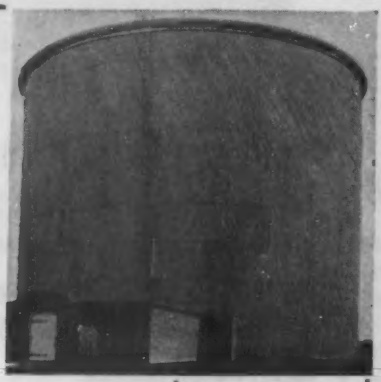
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.

(*Continued from page 1*)

should be done, and the order of their doing, and (2) the Federal Government embarks upon a plan to aid municipalities, States, and governmental divisions, together with industry, to relieve the cause of stream pollution." "Section 8 of the bill authorizes appropriations of $300,000 annually to defray the expenses of the establishment and maintenance of the Division of Water Pollution Control and for the investigations to be made under this measure, and section 9 authorizes appropriations of $700,000 annually for 10 years to be paid to the States for expenditures by or under the direction of their respective State boards or departments of health in the promotion, investigation, surveys, and studies necessary in the prevention and control of water pollution; this sum to be allotted, under the supervision of the Surgeon General of the Public Health Service, to the States in accordance with rules and regulations prescribed by the Secretary of the Treasury." "Your committee decided, as the public health is the main object to be considered in connection with this legislation, that the Bureau of the Public Health Service is the logical division in which to place the administration of this legislation. This bureau has been making studies and investigations of this subject for 30 or more years, the records of which are in its files. Also, there is in each State a health agency, and the

(*Continued*)

GENERAL STEEL PLATE CONSTRUCTION
★
GRAVER
TANKS
WATER CONDITIONING EQUIPMENT



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SETTLERS
FILTERS FOR MINERAL, TASTE, COLOR, ODOR REMOVAL
LIME AND SODA SOFTENERS
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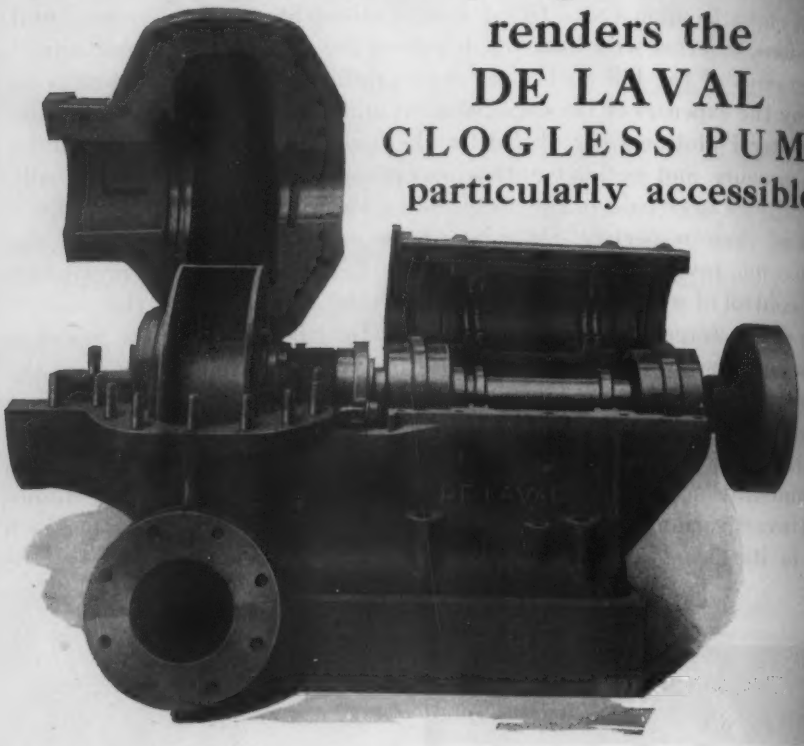
The Horizontally Split Casing renders the DE LAVAL CLOGLESS PUMP particularly accessible



THE entire top half of the casing can be removed without disturbing piping. There is also a large handhole plate directly over the suction. An open or an enclosed impeller is used, according to the character of the liquid. Efficiencies approach those of standard clear water pumps.

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DE LAVAL STEAM TURBINE COMPANY

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Manufacturers of Steam Turbines, Centrifugal Pumps, Propeller Pumps, Rotary Displacement Pumps, Centrifugal Blowers and Compressors, Worm Gears, Helical Speed Reducing Gears, Hydraulic Turbines, Flexible Couplings. Sole Licensee of the Bauer-Wach Exhaust Turbine System.

4079

(*Continued from page 7*)

majority of these agencies have a division of sanitation which is more or less familiar with pollution problems."

The subject is now before the Senate as the Barkley bill (S 702). It is to be hoped that all groups seriously interested in improved condition of streams in the United States will urge the passage of the Barkley-Vinson bills, since they follow the logical path of increasing the funds and authority of already existing agencies well suited to the handling of this important problem.

Installation of a little giant new pumping unit able to pump in one hour enough water to supply a city of 20,000 population for an entire day is announced by officials of the Hackensack Water Company. Designed for economy of space and flexibility of operation, the unit, consisting of a steam engine of new design operating a centrifugal pump with a maximum pumping rate of 45,000,000 gallons per day, pumps untreated reservoir water from the intake channel into the coagulating basin, first step in the cycle of purifying and delivering water into the system of mains which supplies a large part of Hudson and Bergen counties.

The new installation is the smallest in size, but the largest in pumping

(*Continued*)

MODERN FIRE PROTECTION

demands

SAFETOP FIRE HYDRANTS

ARE you planning any water service extensions in your community? If so, be sure to specify Kennedy SAFETOP Fire Hydrants—to provide maximum protection to the neighborhood, with minimum maintenance expense to your department. Kennedy SAFETOP Fire Hydrants meet modern fire service requirements, modern traffic conditions, and modern standards of practical design combined with attractive appearance. *Write for full information*

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KENNEDY
SAFETOP
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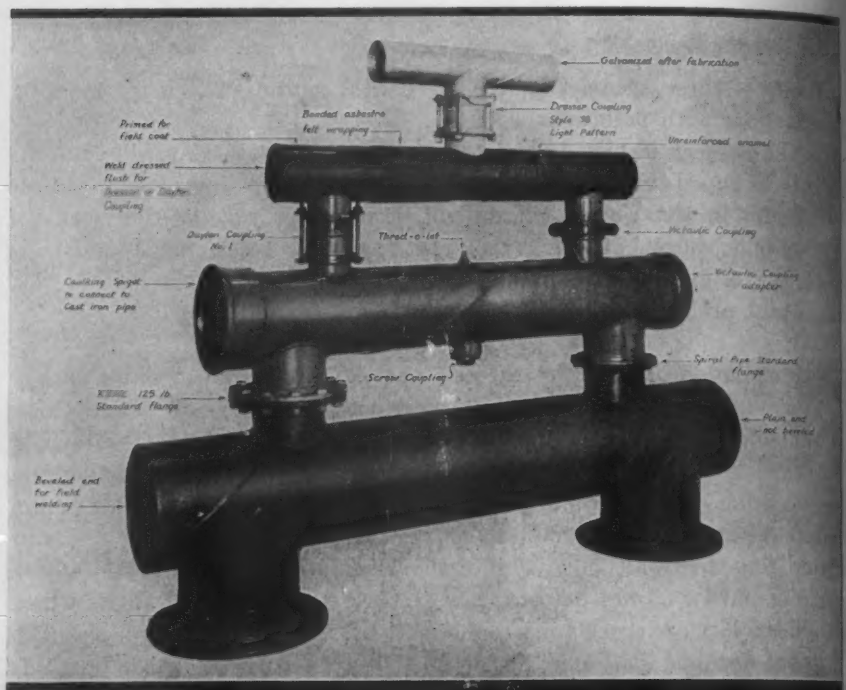
FIRE HYDRANT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TAKE YOUR CHOICE

• Designing with Armco Spiral Welded Pipe you have your choice of various wall thicknesses, coatings, joints and either standard or special fittings.

This broad *adaptability* enables you to select the one "combination" best suited to your *individual requirements.* Wall thicknesses range from 7/64 to ½-inch; diameters, from 6 to 36 inches, with any length up to 40 feet.

And remember, Armco pipe is exceptionally strong and ductile. It handles easily; goes in fast. And its smooth interior assures high flow capacity.

Reap these important advantages on your next waterworks job by mailing your specifications to The American Rolling Mill Co., Pipe Sales Division, 903 Curtis St., Middletown, O.

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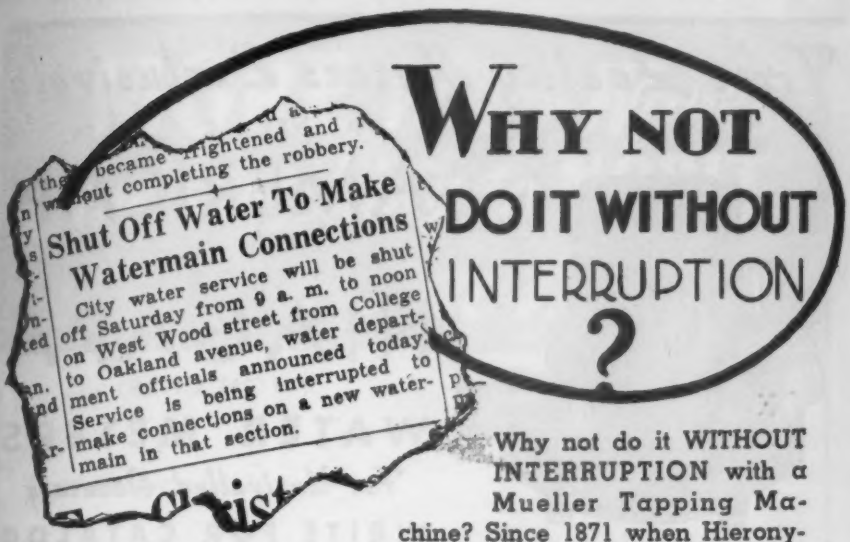
became frightened and
without completing the robbery.
Shut Off Water To Make
Watermain Connections
City water service will be shut off Saturday from 9 a. m. to noon on West Wood street from College to Oakland avenue, water department officials announced today. Service is being interrupted to make connections on a new watermain in that section.
WHY NOT
DO IT WITHOUT
INTERRUPTION
?

Why not do it WITHOUT INTERRUPTION with a Mueller Tapping Machine? Since 1871 when Hieronymus Mueller perfected the first machine for tapping mains under pressure, this type of shut-down has become needless.

Water Tapping Machine "B"

For tapping water mains and inserting corporation stops ¼" to 1" inclusive, in mains under pressure.

MUELLER

TAPPING MACHINES

Are generally used for tapping and inserting corporation stops in mains under pressure. They may be adapted to other purposes such as inserting pipe plugs, or straight drilling and tapping operations in dry pipe. The fact that more than 95% of the water companies have standardized on Mueller Tapping and Drilling Machines is proof of their record of lowering installation and maintenance expense.

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WATER METERS

For Unrivalled Accuracy

WRITE FOR CATALOG

BUFFALO METER CO.

ESTABLISHED 1892 2914 Main Street Buffalo, N. Y.

(*Continued from page 11*)

capacity, of the three low-lift systems put into service since 1905, and embodies the most recent advances in pump and engine design. The pumps were originally installed in 1905, when the filtration plant went into operation, each with a daily capacity of 24,000,000 gallons. In 1914, to take care of increased demand, the company put in a new pump with a capacity of 36,000,000 gallons daily, and of far greater efficiency than the old unit. So great had been the improvements in pump design in the meantime that less than half as much steam was required to run the 1914 pump as was needed for the original unit. The newest system, driven by a steam engine of recent design, registers a further decrease in steam requirement of approximately 25 percent, despite a corresponding increase in pumping capacity.

Because the level in the coagulating basin must be kept nearly constant, owing to the gravity feed to the filter beds, the pumping rate to the basin has to be varied as the consumption demand changes throughout the day. With the new engine this flexibility is achieved by means of an electric motor mounted on the flywheel. A lever located near the meter registering the basin level acts as a remote control, and the motor operates through a worm gear to adjust the spring tension in the engine governor for any required speed.

(*Continued*)

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The answer is:

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- **Higher purification . . . . at lower cost.**
- **Proof—supported by the testimony of well-known users—is yours for the asking.**

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See us at the Buffalo Convention

Proven **EQUIPMENT FOR THE WATER INDUSTRY**

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HELLIGE
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Equipped with solid glass color standards. The only permanently reliable standards for chlorine and pH control, and all other popular water tests.

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Eliminates the preparation and use of standard solutions. Easy to operate. Produces results of highest accuracy and reads turbidities down to zero.

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The ideal outfit for accurate electrometric pH determinations with glass electrodes. Reads direct in pH. Rugged—extremely simple to use—attractively priced.

HELLIGE, INC. 3718 NORTHERN BLVD. LONG ISLAND CITY, N.Y.

(*Continued from page 18*)

Full details of the tests on Transite pipe made by the Underwriters Laboratories may be obtained upon request from Johns-Manville, 22 East 40th Street, New York City. Following a check of the European service records, the laboratory staff conducted hydrostatic, flexural, impact and crushing tests. Brief reference to the data will be found in the report of the A. W. W. A. Committee on Transite Pipe, which will be found on page 607 of this issue.

The American Pipe Manual is now in its tenth edition, ready for distribution by the American Cast Iron Pipe Company of Birmingham, Ala. Copies will be sent free on request to any office of the Company. A general idea of the content of the Manual is gained from the following section titles: 1, History; 2, Mono-Cast Centrifugal Pipe; 3, Bell & Spigot Pipe & Fittings for Water Service; 4, Bell & Spigot Pipe for Gas Service; 5, Flanged Pipe & Fittings, A. W. W. A. and American Standard; 6, 2" Cast Iron Pipe; 7, Special Joints for Cast Iron Pipe; 8, Cement-Lined Pipe & Fittings; 9, Cast Iron Well Tubing & Casing; 10, Monoloy Threaded Cast Iron Pipe; 11, Acipco Cast Iron Columns; 12, Miscellaneous Tables & General Information for Water & Gas Works Superintendents, Engineers and Contractors.

(*Continued*)

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PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892,* **431 S. Dearborn St., Chicago, Ill.**

YOUR DOLLAR'S WORTH IN A METER SETTING

It is just as much false economy to set a water meter in the cheapest way as it is to do the plumbing of a house in the cheapest way—

A water meter set in a Ford Yoke or in a Copperhorn Meter Coupling can be easily removed and replaced without disturbing the service pipe—

This one fact alone justifies what slight extra cost there may be—

THE FORD METER BOX CO.
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Water Meter Setting and Testing Equipment

Ford Yoke for Setting on Risers

Straight Line Yokes for shallow meter box or basement settings in horizontal piping

Saves Coup-lings *Saves Fit-tings*

Ford Copperhorn Meter Coupling

ADVERTISING

in this

JOURNAL

means more

BUSINESS

(*Continued from page 22*)

Water-pipe Noises. "The subject of acoustics in buildings was dealt with by Dr. A. J. Davis, of the National Physical Laboratory, in a lecture at the Building Centre, New Bond Street, London, this being the first of a series of lectures arranged by the Department of Scientific and Industrial Research in connection with its Science and Building Exhibition at the Centre. Modern conditions brought two main acoustical problems in buildings. The first was to ensure that speech and music should be heard naturally and distinctly in auditoriums, and the other to ensure that unwanted noises were excluded from buildings of all descriptions. The lecturer discussed the various problems of echoes and reverberations, and experiments made with partitions, doors and windows, floors and ceilings, and ventilating ducts."

"In conclusion, Dr. Davis said that it was also important to avoid any short circuiting of sound insulation by direct metallic connection through water pipes or gas pipes. Sometimes a noise heard more or less over the whole of a large building might be traced to a small pump in the

(*Continued*)

Our completely outfitted traveling water works laboratory. Equipment includes apparatus to determine the influence of various coagulants upon different potable waters.

FRED STUART *says:*

Gentlemen: Here's a *new Alum company* manufacturing—

BLACK ALUM—*activated sulphate of alumina*—
Our Activated Alum is compounded with a specially prepared activated carbon for "Taste and Odor Control." Developed by "Water Works Men for Water Works Use"—write for a list of users.

STANDARD ALUM—*commercial aluminum sulphate*—
Regular aluminum sulphate of the same specifications as ordinarily used in water treatment and paper making. All these products produced in a new plant—With New Machinery—New Manufacturing Methods—New Cost Figures.

COAG—*ferric sulphate of alumina*—
A new product developed to coagulate under a wide range of conditions—especially recommended for waters difficult to treat and for chemical treatment of sewage.

Activated Alum Corporation will appreciate the opportunity of bidding on your coagulation requirements.

Activated Alum Corp.

Office:
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New York, N. Y.

Works:
CURTIS BAY
Baltimore, Maryland

DIFCO

Liquid Confirmatory Media for the Coli Test

The eighth edition of "Standard Methods of Water Analysis" includes a number of liquid media suggested for use in confirmation of the presumptive test for coli. It is recommended in "Standard Methods" that selection of anyone of these media be based upon correlation of the confirmed tests with a series of completed tests.

These liquid confirmatory media are now available in dehydrated form and are offered as standardized, convenient and reliable media for rapid confirmation of the presence of coli in water.

When used for this purpose, material from positive presumptive tubes is inoculated into fermentation tubes of the confirmatory media and observed for gas production after incubation.

Bacto-Brilliant Green Bile 2%
Bacto-Crystal Violet Lactose B. oth
Bacto-Fuchsin Lactose Broth
Bacto-Formate Ricinoleate Broth

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

DIFCO LABORATORIES
INCORPORATED
DETROIT, MICHIGAN

(*Continued from page 26*)

basement employed for circulating hot water. Indeed, there had been cases where the pump had been found in a boiler house fifty yards away, the noise having travelled via the hot water pipes in their underground duct. Some of this noise possibly travelled through the water, but much of it came by direct metallic conduction along the pipe, and gains of 20 decibels could be achieved by fitting lengths of flexible rubber piping in the pipes from the circulating pump. Taps were liable to be noisy particularly when there was high pressure and a fair but restricted flow. The noise arose from turbulences as the water passed rapidly through unstreamlined constructions. Taps affording a streamline flow were said to have been used successfully in Germany."

"The so-called "hammer" of heating systems might be reduced by suitable ventilation of the systems; and the noise of cisterns was sometimes abated by fitting a tap on the supply pipe and thus restricting the water passing to the ball valve, and thereby suppressing the loud hissing noises which frequently arose."—British Water Works Association Official Circular, April, 1937.

Water Mains in Cold Weather. "The president of the British Waterworks Association recently stated that the loss of water through burst

(*Continued*)

(*Continued from page 30*)

service pipes at Leeds during January and February of last year amounted to sixty million gallons, and he urged the necessity of taking steps to protect serviice pipes more effectually. Innumerable cases might be quoted in support of this contention. We have other instances, such as the freezing up of the tunnel grating of the Wakefield Reservoir and similar occurrences at Cardiff and Preston. Many can still remember the freezing up and bursting of water mains all over the London district in the year 1895, and serious frost troubles on many other occasions."

"A discussion of experiences in different places in America during the winter of 1935–36 has been obtained from seventeen cities, ranging from Duluth, Minnesota, and Omaha, Nebraska, in the north, to Detroit, Michigan, and Louisville, Indiana (?), farther south. The depth of mains is evidently a very important matter, because the frost penetrates to great depth. It does not appear, however, that any factor of safety is allowed, the mains being laid generally at the maximum depth to which frost is expected to penetrate. When the ground is frozen above the main, impact from heavy traffic transmitted through the frozen earth is sometimes found to break the main. The frost strikes deeper in loose, sandy soils than in those having a greater moisture content."—The Surveyor, 8th January, 1937.

L. S. Vance has been appointed Chief Engineer of the Louisville Water Company to succeed John Chambers who died in January. Vance has been Principal Assistant Engineer of the Louisville property for several years and was in active charge of operations during the 1937 flood period. Only thirty-eight years old, a graduate of Cornell, his active work has been continuous with the department since his graduation. He is Past Chairman of the Kentucky-Tennessee Section, A. W. W. A., and active in Association affairs.

Employee activities apart from their working hours offer the best means of promoting team work and understanding. All the way from the simple annual picnic through bowling teams, soft ball and horseshoe pitching leagues the development can go up to the marvelous organization and activities of the Los Angeles Department of Water and Power. Their Employees Association sponsors a Credit Union, special hospitalization services, a Current Events Forum, a Rod and Reel Club (with special fishing excursions—Oh Boy!) along with the more conventional activities.

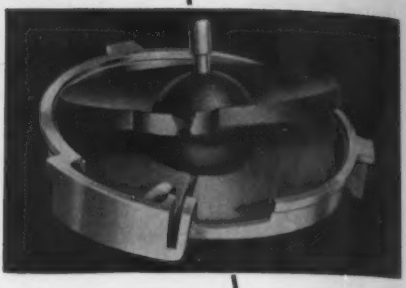
The Springfield, Illinois, Department of Water and Power, among its other activities, sponsors a fine chorus. The group sang at the dinner of the Illinois Section during the recent meeting and gave a fine demonstration of training and real singing ability. The Indianapolis Water Company employees tried a new one this year—a "better speech" class. It was

(*Continued*)

L. H. NASH

A NATIONAL NAME FOR ACCURATE, DEPENDABLE, ECONOMICAL WATER METERING

THE V-type DISC



Friction and wear . . . the common causes of increasing inaccuracy and repeated replacements of water meters . . . are reduced to a minimum in the L. H. Nash Meter by exclusive design features.

The V-Type Disc, for example, does not demand such mechanical control devices as thrust rollers or control blocks. The disc lays on its side and nutates around its precision-finished, water-lubricated, hard-rubber ball, balanced by the pressure at inlet and outlet ports.

Thus the measuring motion of this meter is a pure rolling motion . . . as free from friction as the nutation of a top. Less friction assures less trouble . . . provides more years of accurate metering at less cost.

Other features of the L. H. Nash Water Meter are advantageous, too . . . why not write for complete information . . . today?

The L. H. Nash Meter is also manufactured to minimize friction. The V-Type Disc alone must pass seven exacting inspections . . . including measurements made in one-ten-thousandths of an inch! Thus design and construction are co-ordinated to produce a water meter that is accurate, dependable, and thoroughly economical.

NATIONAL METER COMPANY

4209 FIRST AVENUE, BROOKLYN, N. Y.

BOSTON CHICAGO DALLAS LOS ANGELES SAN FRANCISCO

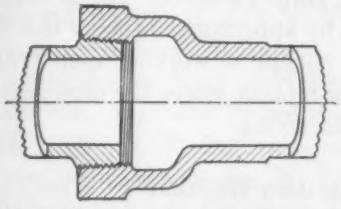
OVER 500 municipalities use American or New York Continental Jewell Water purification equipment.

WATER FILTERS
WATER SOFTENERS

Proportionate Electro-Magnetic Chemical feeders for feeding lime, acid, alum, soda ash. etc.

AMERICAN WATER SOFTENER COMPANY
Lehigh Avenue and 4th St.
Philadelphia, Pa.

ACIPCO
2" C.I. PIPE



ACIPCO 2" cast iron pipe introduces the permanence, dependability and economy of cast iron pipe into small service and distribution lines, building piping, small pump lines, etc. Furnished with ordinary B & S joints, prepared joints, or mechanical joints, and with complete line of fittings. Cast in 5-ft. lengths, but usually shipped in convenient 20-ft. lengths with intermediate joints made up by use of oversize threaded intermediate joint as shown above. Write for details.

AMERICAN
CAST IRON PIPE CO.
Birmingham, Ala.

Without a second thought, millions of people drink the water that flows from their faucets . . . that is served at their tables every day in the year.

They drink it without question because they know it is pure . . . because they realize that every possible precaution has been taken to safeguard household water against contamination.

That places a lot of responsibility on the waterworks engineer. And in turn . . . a heavy responsibility on the organizations whose business it is to supply the chemicals for treating water supplies.

General Chemical Company Aluminum Sulphate is manufactured under the most rigid technical control of quality. It is a product on which engineers can rely for strict uniformity of chemical and physical composition. It remains free-flowing . . . dissolves quickly and can be supplied in a wide range of grades and particle sizes.

Write for data on grades and prices of General Chemical Company Aluminum Sulphate.

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ALUMINUM
SULPHATE

KITSON
UNIVERSALLY USED
PRODUCTS
BY WATER WORKS

C-129 Corporation Stop
Quarter or 90° Coupling
Lead Pipe Connection

C-164 Roundway S. & W. Copper
Pipe Couplings Both Ends

C-171 Curb Stop
Inverted Key—Roundway
Copper Pipe Couplings Both Ends

KITSON COMPANY
2409-15 WESTMORELAND STREET
PHILADELPHIA, PA.

Manufacturers of: Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.

(*Continued from page 35*)

an altogether voluntary activity but resulted in much profit to the participants.

The old saying that "two's company, three's a crowd" can be worked over to the benefit of a water department by applying the theory that the crowd can be unified by group activities outside of working hours. And the start can be made and found useful in a plant where the crowd is not much larger than that referred to in the old saying.

Shall it be "Master Plumber" or "Sanitary Engineer"? What's in a name? the old question was raised in a recent meeting of the New York State Association of Master Plumbers. One speaker said "As a matter of fact, the master plumber is an industrious and hardworking individual who fits in the same category as any other highly specialized engineer. His work is technical. It requires long periods of apprenticeship and the successful fulfillment of examination and licensing specifications. Hereafter, instead of using the term master plumber, I am going to substitute the term sanitary engineer. It might be a worth-while idea to have the industry adopt this phrase officially and to change their association identification accordingly."

(*Continued*)

(*Continued from page 38*)

That of course is just one man's opinion. Another idea can be offered—that there are many, many "engineers" these days and the title is not so distinctive as might be wished. On the other hand, there is a mighty fine sound to the word "master" and the name of "plumber" has its roots in the days of the Roman Empire. The combination of the two words indicates clearly and precisely the title of a group that has a definite part in the healthy existence of every large city—a group of able men who have done much in recent years to add dignity to the title and who can still add more dignity to an ancient and honorable trade name.

Water Service Line Materials will be the subject matter for study by a new Water Works Practice sub-committee. The scope of their assignment is defined as follows: "The review, approval and publication of specifications for copper, iron (wrought or cast) lead, etc. tubing or pipe in sizes and weights suitable for water service lines. The committee may also, to a limited extent, review and summarize current methods of installation of service lines."

The personnel of the committee is as follows: Walter A. Peirce (Chairman), Manager, Racine Water Dept., City Hall, Racine, Wis., Frank C. Amsbary, Jr., Supt., Illinois Water Service Co., Champaign, Ill., Paul D. Cook, Lake County Sanitary Engineer, Court House, Painesville, O., John C. Detweiler, Construction Engineer, Metropolitan Utilities District, Omaha, Nebr., Dwight E. Gross, Chief, Board of Water Commissioners, Box 629, Denver, Colo., E. E. Jacobson, Chief Engineer, Lexington Water Co., 167 N. Upper St., Lexington, Ky., C. D. Moon, Manager, New Jersey Water Co., 610 Station Ave., Haddon Heights, N. J., R. H. Martindale, Supt. of Water Works, Sudbury, Ont., Canada, Reeves J. Newsom, American Water Works & Electric Co., 50 Broad St., New York, N. Y., H. V. Pedersen, Supt. of Water Works, Municipal Bldg., Marshalltown, Ia., George W. Pracy, Supt., San Francisco Water Dept., 425 Mason St., San Francisco, Calif., Edward H. Ruehl, 902 Travelers Bldg., Richmond, Va., F. Albert Schaefer, 711 E. Market St., New Albany, Ind., W. E. Swartz, Secretary-Manager, Public Utilities Commission, Petrolia, Ont., Canada.

Ten new industries have been brought into being through applied research fellowships of Mellon Institute during recent years. These, and the development or invention of about 650 new processes and products, are among major accomplishments of the Institute since its founding in 1913, according to Dr. Edward R. Weidlein, its director. The Institute dedicated its new building May 5–9, with visiting scientists and industrial leaders from many parts of the world attending.

(*Continued*)

(*Continued from page 43*)

New industries also have been built on the results of applied research into the recovery of various by-products from coal and coke, some of them resulting in such products as disinfectants, fungicides, insecticides, varnishes, paints, resins, electrical insulating materials, turpentine substitutes, substitutes for linseed-oil, wood preservatives and many other branches.

Outstanding industrial research results at the Institute include development of chrome-plating of aluminum to commercial applicability, evolution of a new yeast food, a new gas for metal-cutting operations, a widely-used dental cement, the working out of a vanadium catalyst for the manufacture of sulfuric acid, improvements in operating methods for various types of refractories, some new sanitary enamels, a new heat-insulating material, a series of vegetable adhesives, improvements in the making of paper, and a new roofing material.

There is a story in the synthesized plastic made from ordinary chemicals which resulted in the complete re-design and reconstruction of a certain type of weighing-scale and of its further evolution to errorless precision. There is another in the perfection of the little-known chemical, sodium metaphosphate, as a boon to laundering, and later to mechanical dishwashing.

The Institute also, in its career of 26 years, has been instrumental in developing a new type of safety-fuse, a new iodine antiseptic, a new kind to steel flooring, a novel core binder for foundry use and—coming back of the average man—a shoe leather impregnated chemically to make it highly scuff-resisting, better wearing, and capable of polishing merely by rubbing with a cloth.

Nor is this all. Not long ago fundamental studies were made by the Institute on such subjects as sleep, smoke abatement, elimination of industrial dusts and the diseases which they cause, shaving, pneumonia, and dental caries. From them have emerged facts never known as to how a person rests while sleeping, the necessity to health for abating smoke and dusts that may cause silicosis or pneumonia, what type of alloy-steel makes shaving easiest for the average man, what drug compounds may be safely used to treat certain types of pneumonia, and what factors affect tooth decay.

Mellon Institute's most notable contributions to public health, through medicine, have come through its Department of Research in Pure Chemistry, under Dr. L. H. Kretcher, which was organized in 1924 to point the way for more fundamental knowledge than was available through applied industrial research. The new building will house a greatly-enlarged department in the pure sciences such as chemistry, physics and biology.

Alan Drake of Buffalo has been a real host to the American Water Works Association in its convention. As every member who attended will testify, his activities extended far beyond the simple field of welcoming them. That in itself is an admirable thing and it is fully appreciated. Less evident but far more important have been the services he rendered to make every local detail meet the needs of the situation. For months, he had the meeting as one of the things uppermost in his mind. From the early contacts with the headquarters hotel, right through every local detail, his willingness to be of service has been translated into effective action.

The Association is further indebted to him for the aggressive membership promotion work he has carried on. Not alone in Buffalo, but in all of western New York, has his campaign gone on. When June 1st came around, Alan Drake had brought into the Association 52 new members, 44 Active, 4 Corporate and 4 Associate. That is a record any man should be proud to make, and now with the convention past, the Association doffs its collective hat and bows in gratitude and admiration to its real host—Alan Drake.

ATTENDANCE AT A. W. W. A. CONVENTIONS

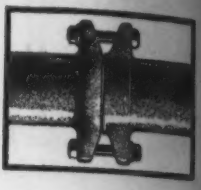
Year	*City*	*Total Registered*
1923	Detroit	1300*
1924	New York	1303*
1925	Louisville	1250*
1926	Buffalo	1268*
1927	Chicago	1609*
1928	San Francisco	566*
1929	Toronto	1104
1930	St. Louis	1021
1931	Pittsburgh	1076
1932	Memphis	712
1933	Chicago	660
1934	New York	891
1935	Cincinnati	901
1936	Los Angeles	891
1937	Buffalo	1140

* No registration fee charged prior to 1929.

(*Continued*)

UNIVERSAL PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

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OFFICES IN PRINCIPAL CITIES COAST TO COAST

ZEOLITE GREENSAND ZEOLITE

FOR WATER SOFTENING AND IRON REMOVAL

Zeolite Chemical Company, 144 Cedar Street, New York

HELP! HELP! HELP!

Journals for January, February and March, 1937, are needed.

Due to the rapid increase in A. W. W. A. membership, these issues are already out of print.

If you do not need your copy of any of these issues send it to this office.

American Water Works Association
29 West 39th Street
New York, N. Y.

(*Continued from page 1*)

Subjects affecting standardization of underground piping systems will be discussed at a conference on corrosion to be sponsored by the National Bureau of Standards during October or November, 1937. Exchange of ideas among those engaged in investigation or mitigation of underground corrosion will be the purpose of the conference. Only hitherto unpublished papers will be presented, and attendance will be limited to those who have contributions to make.

Topics suggested which will have a bearing on standardization are:

Methods for determining the corrosivity of soils.

Methods for determining the condition of pipe lines.

Tests and specifications for pipe coatings.

Any one wanting to take part in the conference should notify K. H. Logan, National Bureau of Standards, Washington, D. C., indicating the subject or general nature of the contribution he wishes to make. He should also indicate his preference as to the date of the conference.

(*Continued*)

GENERAL STEEL PLATE CONSTRUCTION
GRAVER
TANKS
WATER CONDITIONING EQUIPMENT

Modernize

Prepare for expansion—look to the future. Check over present equipment. Bring it up to date. Let us work with you on designing, fabricating or erecting any kind of tanks, water treating equipment or steel plate work—

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75 Years of Dependable Service

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SETTLERS
FILTERS FOR MINERAL, TASTE, COLOR, ODOR REMOVAL
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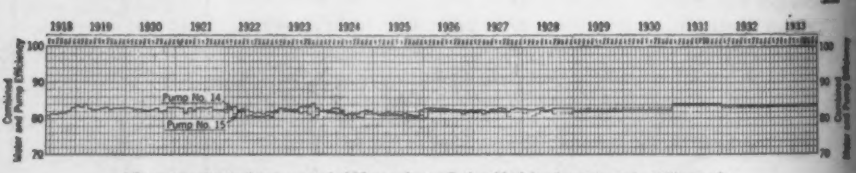
- The most notable development in centrifugal pump design;
- Sustain efficiencies for years without repair or overhaul expense;
- Hold leakage to a minimum, while permitting relatively large mechanical clearances;
- Reduce wear because of both the lower velocity of flow and the greater initial clearance;
- Made to limit gages and easily renewable;
- No finishing cut required on impeller ring after mounting;
- Save replacing impeller or reboring casing.

The fact that De Laval Centrifugal Pumps sustain their high efficiencies for years makes them a most profitable investment. Official records of tests and maintenance costs substantiating this statement are given in Catalog E-1166, sent upon request.



Efficiencies maintained over a period of 15 years by two De Laval high head pumping units at Minneapolis.

DE LAVAL STEAM TURBINE CO., TRENTON, N. J.

A Branch Connection While the Water Flows

QUICKLY, easily, safely, a 30" branch connection can be cut into a 30" or larger main by the use of a Smith Tapping Machine while the water in the main flows merrily along under its usual full head of pressure.

Shut-downs are avoided. They are unnecessary. Expense is saved. Danger is avoided. Health is protected.

This machine is power-operated. It uses an air-motor which supplies a smooth, steady flow of power which enables it to cut through the hardest main in less than an hour.

Other sizes of Smith Tapping Machines will make branch connections from 2" to 42" into any size mains not smaller in diameter than the connection desired.

Smith Tapping Machines are standard equipment today in the water and gas fields.

Send for full details

SMITH

TAPPING MACHINES

The A. P. Smith Manufacturing Company

East Orange, New Jersey

Smith Tapping Machines—Tapping Sleeves and Valves—O'Brien Hydrants—Valve-Inserting Machines—Removable Plugs, Pipe Cutting Machines—Corporation Tapping Machines—Gas Tee-Inserting Machines—Corporation Cocks—Federal Water Meters.

First Quality Meters Exclusively

S P E C I F Y

AMERICAN
(BRONZE CASE)
OR
NIAGARA
(IRON CASE)
WATER METERS
For Unrivalled Accuracy
WRITE FOR CATALOG

BUFFALO METER CO.
ESTABLISHED 1892 2914 Main Street Buffalo, N. Y.

(*Continued from page 11*)

The insistence of users of zinc-coated pipe that a heavy coating of zinc, such as that specified in American Standard G8.7-1937, is necessary to insure long life for this type of pipe has been substantiated by the recent investigations of the National Bureau of Standards.

For a number of years prior to 1934 zinc-coated steel pipe was customarily furnished with a light coating for ordinary purposes, because the specifications of the American Society for Testing Materials for this type of pipe did not include definite requirements for weight of coating. In 1934, the A.S.T.M. specifications A 120 were revised to provide weight of zinc coating of not less than two ounces per square foot of total coated surface. In this form the specifications were approved by the American Standards Association as American Tentative Standard. This tentative standard was advanced by the A.S.T.M. to the status of standard, and has now been advanced to American Standard G8.7-1937, by the American Standards Association.

The conclusions of the investigations of the National Bureau of Standards are that these heavier zinc-coatings are superior to thin ones for long periods of service and that galvanized steel loses weight at rates of from

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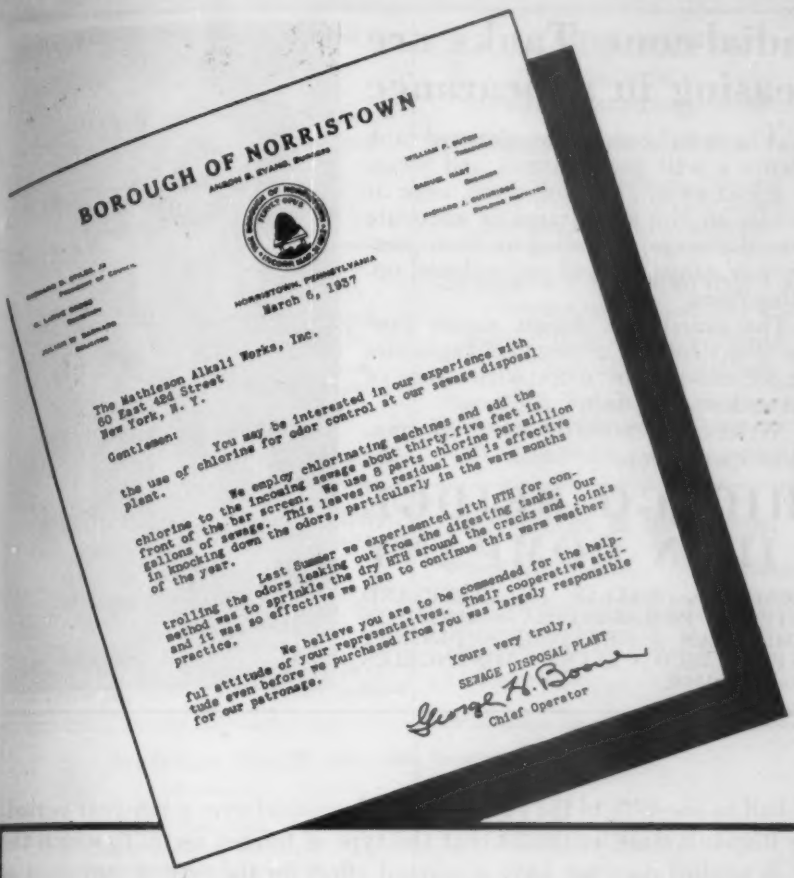


BOROUGH OF NORRISTOWN

NORRISTOWN, PENNSYLVANIA
March 6, 1937

The Mathieson Alkali Works, Inc.
60 East 42d Street
New York, N. Y.

Gentlemen:

You may be interested in our experience with the use of chlorine for odor control at our sewage disposal plant.

We employ chlorinating machines and add the chlorine to the incoming sewage about thirty-five feet in front of the bar screen. We use 8 parts chlorine per million gallons of sewage. This leaves no residual and is effective in knocking down the odors, particularly in the warm months of the year.

Last Summer we experimented with HTH for controlling the odors leaking out from the digesting tanks. Our method was to sprinkle the dry HTH around the cracks and joints and it was so effective we plan to continue this warm weather practice.

We believe you are to be commended for the helpful attitude of your representatives. Their cooperative attitude even before we purchased from you was largely responsible for our patronage.

Yours very truly,

SEWAGE DISPOSAL PLANT

George H. Bowne

Chief Operator

WHETHER the job in hand be water purification, sewage treatment or swimming pool sanitation, you have a right to expect a dependable supply of liquid chlorine—a pure product, trouble-free containers and valves, prompt delivery service. It is because Mathieson Liquid Chlorine has proved its dependability in these three essentials that the Borough of Norristown, Pennsylvania—the "largest borough in the world"—together with so many other consumers, specify "Mathieson" whenever there is a chlorinating job to be done.

The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street **New York, N. Y.**

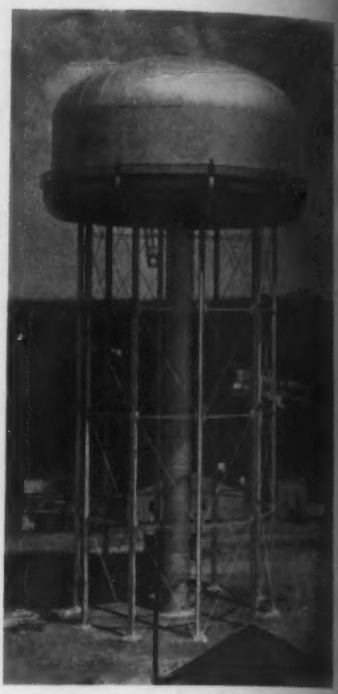
Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . . HTH and HTH-15 . . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Solid Carbon Dioxide

Radial-cone Tanks are pleasing in appearance

The radial-cone design elevated tank presents a well proportioned and pleasing appearance. At the same time it provides all the advantages of adequate elevated storage, including uniform pressure, low range in head and reduced operating costs.

The radial-cone design makes possible practical and economical capacities of 2,000,000-gal. or more with range of head as low as 25 feet.

Write our nearest office for information or quotations.



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B-309

(*Continued from page 18*)

one-half to one-fifth of the rate of loss of bare steel over a ten-year period. The Bureau's study indicates that the type of ferrous metal to which the zinc is applied does not have a marked effect on the rate of corrosion of galvanized materials during the first ten years of exposure. Further, the rate of corrosion of galvanized steel varies with the character of the material exposed to the soil. Corrosion is higher when zinc alone is exposed than when the alloy layer is exposed and highest after much of the alloy layer is destroyed.

The Bureau's study with respect to the lead coatings is summarized in the following conclusion:

Lead is sufficiently corrodible in most soils to result in the penetration of lead coatings of the thickness now used within ten years. After the lead has been punctured, accelerated corrosion may occur because of the differences of potential between lead and steel.

Latest results of the Bureau's study of metallic pipe coatings are given in Research Paper 982, reprints of which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

(*Continued*)

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Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.

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Sewerage and Sewage Disposal
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Appraisals, Valuations and Reports
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Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swiming pool control.

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Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.

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Water Waste Surveys
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MABB'S

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

YOUR DOLLAR'S WORTH IN A METER SETTING

It is just as much false economy to set a water meter in the cheapest way as it is to do the plumbing of a house in the cheapest way—

A water meter set in a Ford Yoke or in a Copperhorn Meter Coupling can be easily removed and replaced without disturbing the service pipe—

This one fact alone justifies what slight extra cost there may be—

THE FORD METER BOX CO.
Wabash, Ind.

Water Meter Setting and Testing Equipment

Ford Yoke for Setting on Risers

Straight Line Yokes for shallow meter box or basement settings in horizontal piping

Saves Couplings

Saves Fittings

Ford Copperhorn Meter Coupling

SPARLING
MAIN-LINE METERS

A velocity type meter, registering directly in gallons, cubic feet or any other volumetric unit desired.

Simple, sturdy construction of long-wearing, corrosion-free materials. All parts interchangeable.

Sizes from two to sixty inch .. or larger.

Easily installed. No frost protection necessary.

With auxiliary Indicator-Recorder, they provide permanent records of hourly, daily and weekly water production and distribution.

Write for Bulletin 303.

H. W. SPARLING
WATER MEASURING EQUIPMENT
945 North Main St., Los Angeles
NEW YORK CHICAGO
CINCINNATI

(*Continued from page 22*)

Large purchasers of gasoline can now refer to proposed specifications prepared by the American Society for Testing Materials, in preparing purchase specifications for gasoline bought under contract.

The proposed Specifications for Gasoline (D439-37 T) have just been authorized for publication as tentative by the A.S.T.M. in accordance with recommendations of its Committee D-2 on Petroleum Products and Lubricants.

They are not a definition of gasoline, the A.S.T.M. announces, nor do they include all types of gasoline or motor fuel satisfactory for motor vehicles because certain equipment or conditions of use may require fuels having special characteristics. They do, however, provide three types of gasoline.

Type A, for use under normal conditions.

Type B, for use where a gasoline of greater over-all volatility than Type A is desired.

Type C, for use where a relatively non-volatile fuel is desired.

The specifications state the required properties of gasoline at the time

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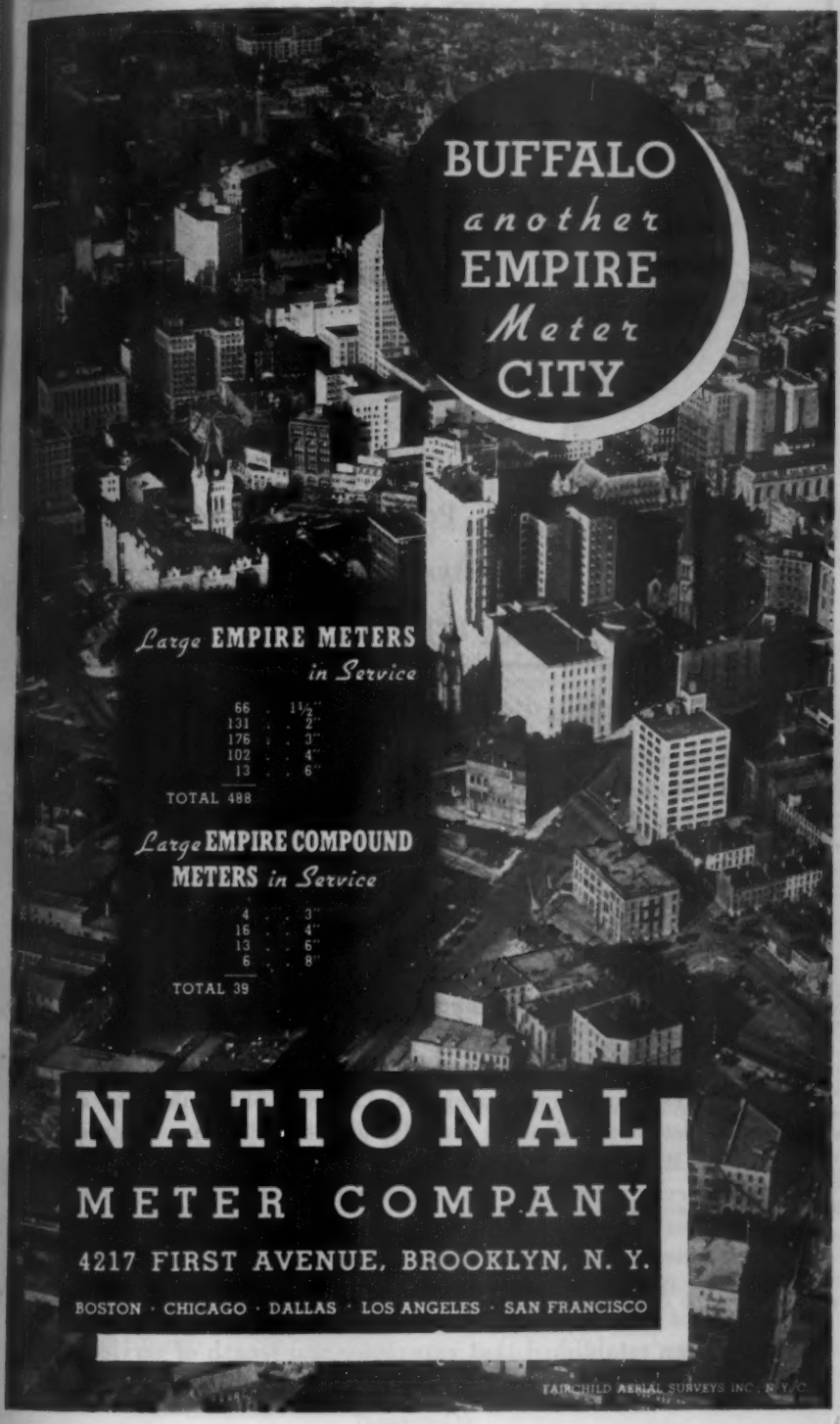

BUFFALO
another
EMPIRE
Meter
CITY
Large EMPIRE METERS
in Service
66 . . 1½"
131 . . 2"
176 . . 3"
102 . . 4"
13 . . 6"
TOTAL 488
Large EMPIRE COMPOUND
METERS in Service
4 . . 3"
16 . . 4"
13 . . 6"
6 . . 8"
TOTAL 39
NATIONAL
METER COMPANY
4217 FIRST AVENUE, BROOKLYN, N. Y.
BOSTON · CHICAGO · DALLAS · LOS ANGELES · SAN FRANCISCO
FAIRCHILD AERIAL SURVEYS INC., N.Y.C.

THE STANDARD
for more than
50 YEARS

WATER WORKS SPECIALTIES

•

Automatic Pressure Control Valves

Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.

(*Continued from page 26*)

and place of delivery in bulk. They provide for an automatic variation by the seller to meet the requirements of seasonal changes in temperature depending upon the season and the locality in which the product is to be used.

"**The ability to perform the job efficiently** is developed most rapidly in a worker through instruction—job training. This is the most resultful method of raising to a higher level the performance of a group of workers, or of an individual worker as a rule" said the Personnel Practices Committee of the A.G.A. in a recent report.

Dr. M. S. Viteles, a foremost authority on the training of industrial personnel, says: 'Industry recognizes the benefits of training new employees, but neglects to train men already on the job with a long period of service. So it happens that groups of employees with relatively short periods of service often have more information, are more dependable, are capable of functioning more efficiently than groups with longer service periods. This situation arises when the first group has been granted the benefit of systematic instruction not made available to the latter by the very reason of length of service.'

"It has been established that experience and length of service give no sure index of superior ability to perform on the job. There has been a

(*Continued*)

(*Continued from page 30*)

failure on the part of experienced workers to keep pace with changing methods of work, partly by reason of stagnation on the part of the worker, but also in many instances because of failure to provide for such workers the opportunity for systematic instruction."

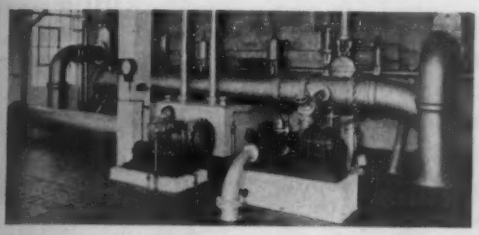
This expresses plainly the fact that in A. W. W. A. approval of licensing of water works operators must also be implied the necessity of in-service training and periodical re-examination of licensees.

Jeff Corydon of Proportioneers, Inc. has joined the ranks of the trailer laboratory fans and is now roving over the country demonstrating his equipment for the feeding of chlorine and the like. If he and Fred Stuart with his activated alum demonstrator ever collide there will be five explosions: two gas tanks, two human beings and the chlorine-carbon mixture. The chemists say the last one is the most dangerous.

Fuel costs in the generation of power can often be reduced by 25 to 50 per cent, or more, is pointed out in a paper entitled "Power and Heat Problems Yield to Improved Alloys and Designs," C. R. Waller, Vice-President in Charge of Engineering, of the DeLaval Steam Turbine Co.,

(*Continued*)

ACIPCO CAST IRON PIPE & FITTINGS



Acipco cast iron pipe and fittings in new filter plant pipe gallery, Greenwood, S. C.

Acipco furnishes a complete line of cast iron pipe and fittings in diameters from 2″ to 36″, inclusive, equipped with B & S, mechanical, or other special joints, plain or with cement or bituminous linings. Write for literature.

AMERICAN CAST IRON PIPE CO., Birmingham, Ala.

Water moves
THICK AND FAST

with
HOMELITE
Portable Pumps

MUDDY WATER doesn't stop work—waste labor hours and dollars—when Homelite Portable Pumps are on the job. For Homelites are not only designed and built to pump 15,000 gallons per hour but to handle seepage and large quantities of solids as well.

Weighing only 93 pounds complete, a Homelite is carried easily by one man. Its capacity means real speed on man-size jobs. Starting is quick, simple. Operation is automatic, trouble-proof on this self-priming pump; and its air-cooled engine won't flood, freeze or overheat. Send for bulletin.

HOMELITE CORPORATION
1606 RIVERDALE AVE. PORT CHESTER, N. Y.

"You'll find it in here, Bill"

● It is second nature in a whale of a lot of plants to reach for a Crane No. 52 Catalog and say, "You'll find it in here," whenever a question concerning valves, fittings or piping arises. It is a mighty sensible habit, too, for your Crane No. 52 Catalog contains more items, more dimensions and more piping engineering data than does any other such publication in the world.

Not only does it have such information but it makes ordering swift and easy—and you know that the valves, fittings and piping which you order will uniformly be of the highest quality. Whatever your next job involving piping may be, turn to your Crane Co. 52 Catalog first. You'll find that for common and for most "new" valve problems, Crane has an answer in items proved and ready for use. They're all among the 38,000 listed in this catalog. Order from it to CranEquip for satisfaction.

"SEE OUR EXHIBIT AT THE AMERICAN WATER WORKS ASSOCIATION CONVENTION, BUFFALO, N. Y., JUNE 7-12."

CRANE

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVE., CHICAGO, ILLINOIS

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, PLUMBING AND HEATING MATERIAL

plied in the next few days.

EASY SOLUTION FOR VALVE INVENTORY

NEW YORK CITY, May 14—The easiest way to solve the inventory problem for valves and valve parts needed to maintain a water or sewage system is to standardize on Crane valves. Parts are instantly interchangeable because of extremely accurate gauging and rigid inspection. Duplicate sizes are avoided, and responsibility for service is focused in one spot.

Standardizing on CranEquipment is a sure method of cutting inventory costs as well as increasing the dependability of your system. From Crane you can purchase practically every item you may need, backed by Crane's reputation for high quality and fine performance.

More than that, the distribution of Crane products through Crane branches and distributors is so widespread that you can keep your inventories low because you can rely on swift service from the Crane organization. Steady progress toward CranEquipping is being made by many a city water and sewage system through the simple method of using Crane products for all replacements and additions. CranEquip for piping satisfaction.

No matter how waters and weather vary

DIXON'S

SILICA GRAPHITE PAINTS

protect waterworks

Waterworks structures and equipment—north, east, south and west throughout the world—protected by Dixon's Silica Graphite Paints report painting costs so low as to be unduplicated by other coatings.

In this there is nothing new or surprising. The pigment—flake graphite combined by nature with silica—is chemically inert and inherently moisture-repellent. The thin, flat flakes plate the painted surface with a shingle-like, overlapping armor that adheres with great tenacity. Put up in pure boiled linseed oil by Joseph Dixon Crucible Co., the result is a coating which excels in long life, covering power and true economy.

For painting the interior of tanks and standpipes, we have a special, proven process that is non-toxic, imparts neither taste, color nor odor and affords maximum protection.

Dixon's Silica Graphite Paint is available in fourteen colors including aluminum. Write for color card and Master Specification BI19.

Paint Sales Division

JOSEPH DIXON CRUCIBLE CO.

Established 1827 — Jersey City N. J.

DIXON'S INDUSTRIAL SILICA GRAPHITE PAINT

Without a second thought, millions of people drink the water that flows from their faucets . . . that is served at their tables every day in the year.

They drink it without question because they know it is pure . . . because they realize that every possible precaution has been taken to safeguard household water against contamination.

That places a lot of responsibility on the waterworks engineer. And in turn . . . a heavy responsibility on the organizations whose business it is to supply the chemicals for treating water supplies.

General Chemical Company Aluminum Sulphate is manufactured under the most rigid technical control of quality. It is a product on which engineers can rely for strict uniformity of chemical and physical composition. It remains free-flowing . . . dissolves quickly and can be supplied in a wide range of grades and particle sizes.

Write for data on grades and prices of General Chemical Company Aluminum Sulphate.

General Chemical Company

Executive Offices: 40 Rector St., New York City

SALES OFFICES

Atlanta • Baltimore • Boston • Buffalo • Charlotte • Chicago Cleveland • Denver • Houston • Kansas City • Los Angeles Minneapolis • Montezuma (Ga.) • Philadelphia • Pittsburgh Providence • San Francisco • St. Louis • Wenatchee • Yakima In Canada: Nichols Chemical Co., Ltd. • Montreal • Toronto

GENERAL CHEMICAL COMPANY

ALUMINUM SULPHATE

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

50 Church St., New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
2587 Glen Echo Drive, Columbus, Ohio
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada.

(*Continued from page 35*)

Trenton, N. J. Recent improvements in the design of steam turbines, and in the materials used for their production, permit of using steam in the region of high pressures and temperatures. As little additional fuel is required for the generation of steam at high pressure, the efficiency of condensing steam plants can in this way be greatly increased. Where steam is used for processing or heating, even at relatively high pressures, large amounts of power can also be obtained as a by-product, using the turbine as a pressure reducer and heat distributor. The possible savings with steam at various pressures and temperatures are presented in a table.

The seventh edition of its Standards for the pump industry has just been published by Hydraulic Institute. The enlarged publication has been completely rewritten and rearranged and much new material has been added, such as a new pump test code, charts for figuring friction of petroleum products in pipe lines, specific pump speed curves, pressure-temperature curves for pumping hot water and chart showing resistance of valves and fittings to flow of fluids. Recommendations of materials to be used in pumps handling various liquids, instructions for installing and operating different types of pumps, and much other material has been revised and brought up to date. Price of the book is $1.00 (one dollar) and copies may be had by addressing the Secretary, C. H. Rohrbach, 90 West Street, New York City.

(*Continued*)

(*Continued from page 38*)

Mexico's oil workers seem to have been reading "The House That Jack Built." Among the demands of the Syndicate of Petroleum Workers which have been rejected by the oil companies as "ridiculous," it was disclosed is the following series:

Triple pay for working on a rest day.

Quintuple pay for working on a rest day that is also a holiday.

Double quintuple pay (ten times normal) for working on a rest day that is a holiday if it rains.

Double that sum (twenty times normal) for working on a rest day that is a holiday if it rains and the heat reaches 97 to 104 degrees.

Triple double quintuple pay (thirty times normal) for working on a rest day that is a holiday if it rains and the heat exceeds 104 degrees.

Double that sum (sixty times normal pay) for working on a rest day that is a holiday if it rains and the heat exceeds 104 degrees and the work is being performed at an altitude above seven meters (twenty-three feet).

The companies had offered, among other things, seven and a half holidays a year with pay.

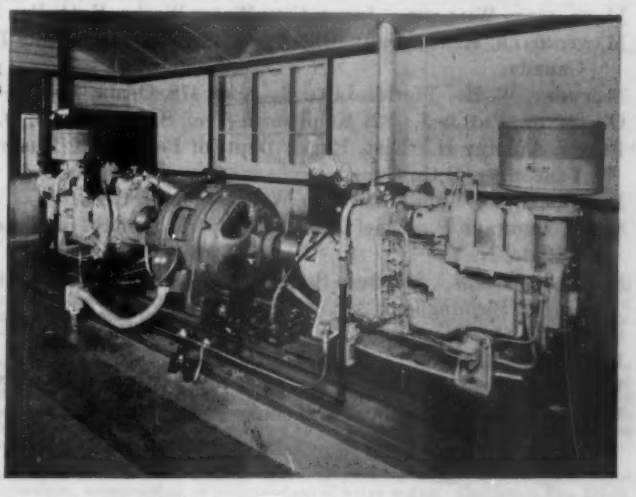
(*Continued*)

ESTABLISHING NEW RECORDS

Report of STERLING crankless Diesel engines built under "MICHELL CRANKLESS ENGINE" Patents after 7 months continuous service:

"At all loads, from no load to full load, the exhaust is absolutely clean, with no sign of either black or gray smoke, this showing the combustion is perfect and that lubricating oil is not passing by the pistons.

"The balance of load between the various cylinders, as shown by exhaust temperature pyrometer—regardless of whether both engines are driving the generator or only one, is especially good. With one engine running the exhaust temperatures taken showed 410°, 410°, 412°, 408°, for the four cylinders, an absolutely equal balance of power between the cylinders."



Installation of 2 STERLING crankless Diesel engines in American Ice Company plant, Sacramento, California

INVESTIGATE THE ADVANTAGES STERLING OFFERS BEFORE YOU BUY A DIESEL.

Catalog on request. Please state your requirements.

STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

(*Continued from page 40*)

TESSIER, A. H. International Water Supply Co., 2011 Maplewood Ave., Montreal, Que., Canada.

THRASHER, W. E. Gen. Supt., Westchester Joint Water Works No. 1, Mamaroneck, N. Y.

VAN DIEN, MILLARD. Supt. of Public Works, Essex Fells, N. J.

WING, FREDERICK K. Cons. Engr., 1314 Prudential Bldg., Buffalo, N. Y.

Reinstatements

AMES, JEREMIAH L. Chief Engr., Western New York Water Co., 11 Niagara St., Buffalo, N. Y.

ARNOLD, ROY N. Supt., Water Dept., Whitefish, Mont.

BOWE, THOMAS F. Cons. Engr., 110 William St., New York, N. Y.

BUCHANAN, GERRIT S. R. D. No. 5, Washington, Pa.

CLARKSON, L. M. State Dept. of Public Health, Atlanta, Ga.

CRAIG, ROBERT H. Cons. Engr., 222 N. Third St., Harrisburg, Pa.

FARMER, JOHN B. Supt. of Water Works, 515 S. Maney's Ave., Murfreesboro, Tenn.

GRAY, A. C. 28 Front St., St. Augustine, Fla.

GRIFFIN FOUNDRY & MFG. CO. Rome, Ga. (Assoc. M.)

GROTZ, WILLIAM H. Asst. Engr., Div. of Water, 50 Lakeview Ave., Buffalo, N. Y.

KASSAY, ALBERT E. Supt., North Tarrytown Water Dept., 29 Gordon Ave., North Tarrytown, N. Y.

LANCTOT, THEO. City Engr., Hull, Que., Canada.

LARKINS, THOMAS H. Supt.-Chemist, Water Dept., Box 497, East Liverpool, O.

MACDONALD, W. E. City Water Works Engr., 330 Driveway, Ottawa, Ont., Canada.

MALLALIEU, WILLARD. Jersey City Water Works, P. O. Box 384, Boonton, N. J.

MARTINDALE, R. H. Supt., Electric Light & Water Works Dept., Sudbury, Ont., Canada.

MEFFERT, W. H. Florida Lime Co., Box 478, Ocala, Fla.

O'CONNOR, PHILIP J. 821 Kenilworth Ave., S. E., Warren, O.

PERRY, AUBREY H. Dist. Engr., Dept. of Pensions & National Health, Box 1012, Vancouver, B.C., Canada.

PILE, RICHARD. Supt. of Water Works, Somerset, Pa.

SPIRE, LEONARD S. Chief Pitometer Operator, Div. of Water, 50 Lakeview Ave., Buffalo, N. Y.

STARNES, TOM M. Southern Sales Mgr., American Cast Iron Pipe Co., 11 Norwood Circle, Birmingham, Ala.

SWEET, E. O. Birmingham Water Co., Birmingham, Ala.

WACKERLIN, GEORGE. Fort Benton, Mont.

WAGNER, HENRY F. Chief Chemist, Div. of Water, Buffalo, N. Y.

WHITE, CHARLES H. Box 744, Asbury Park, N. J.

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
29 W. 39th Street, New York, N. Y.

Date:.....

.....hereby make application for.....Membership
(I or We) (Active, Corporate or Associate)
in the American Water Works Association, and enclose herewith the sum of

$.....the required initiation fee* and one year's dues in advance.

Name.....

Title or Business.....

Address.....

.....

.....

Business or Professional Experience.....

.....

.....

.....

.....

ARTICLE I OF BY-LAWS

Section 3. An Active Member shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Initiation Fee, $5.00; Annual Dues, $10.00.)

Section 4. A Corporate Member shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Initiation Fee, $10.00; Annual Dues, $15.00.)

Section 5. An Associate Member shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Initiation Fee, $10.00; Annual Dues, $25.00.)

Membership in the Association carries also membership in its Local Sections and National Divisions, and includes the Journal a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies.

* *Initiation Fee Waived During 1937*

(*Continued from page 41*)

The Central Foundry Co., manufacturers of Universal cast iron pipe and other materials for the water supply and sanitation field, announce the opening of new offices at 386 Fourth Avenue (corner 27th Street), New York City.

Bacteria have been awakened from a sleep of 8,000 years or more, Dr. Ira B. Bartle, of San Luis Obispo, Calif., reported from the Pyramid of the Sun at Tehotihuacan. Archeologists in Mexico say it is the oldest structure made by human beings in the Americas.

Dr. Bartle cut a chunk out of the heart of the pyramid with permission of the Mexican government. In it were sleeping bacteria. He awakened them and they started reproducing.

"I can positively state that there are bacteria in the heart of the Pyramid of the Sun at Tehotihuacan, because I had thirty-four colonies on 200 milligrams of material in ninety-six hours," he reported.

The appointment of J. J. Summersby Assistant Vice President of Worthington Pump and Machinery Corporation, as General Sales Manager of that Corporation is announced. This appointment is an extension of Mr. Summersby's previous responsibilities, for a further concentration of direction of the Corporation's general sales department.

Mr. Summersby joined the Worthington Pump and Machinery Corporation as a sales engineer immediately after his completion of post-graduate work at Washington University in 1920, and has been continuously identified with the Corporation since then as district sales manager, divisional sales manager and assistant general sales manager.

Sales of bathtubs and other plumbing fixtures have increased 25 per cent thus far in 1937 over the corresponding period last year, George H. Werner of Orange, N. J., president of the National Association of Master Plumbers, said at the association's fifty-fifth annual convention.

Mr. Werner added, however, that plumbing prices had lagged behind a rising market and that fixtures were selling for about 30 per cent less than in 1926.

A. L. McGonigal, of Washington, chairman of the association's sanitation committee, said that his committee favored having trailers use parks and camps where plumbing facilities were available rather than installing plumbing facilities into the trailers. He said trailers had been known to spread typhoid because of improper sanitation.

George C. Andrews, former Water Commissioner of Buffalo, died suddenly from a heart attack on May 30th. He will be remembered well by many older members of the Association.

Kenneth Shibley of Seattle, Wash., an honored active member of the Pacific Northwest Section, died on May 3rd.

NEWS OF THE FIELD

We need JOURNALS! Our conservative printing schedule on the JOURNAL found itself unable to meet the demand due to rapid growth in membership of the Association. The stock of January and February (1937) issues is already exhausted and the March stock is being rapidly depleted. May we have your help? If you do not file your JOURNALS permanently will you advise us that you have these issues available? We will then forward you an addressed envelope for the copies so that they can be sent to certain new members who are anxious to have their volume complete. 50¢ will be paid you for each copy so forwarded. You will do the Association a real service by making it possible to take care of this unprecedented demand. Please help us!

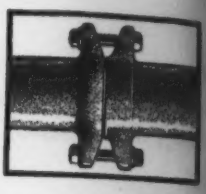
The American Water Works Association has reached during the current year, a new all time high record for membership. Activity prior to the Buffalo convention lead to a substantial number of additions by the close of that event. Deductions for deaths and resignations during the month left a net total membership of 3017 on June 30th. The previous peak of 2960 was recorded in November, 1930, at the close of Arthur Gorman's great membership drive of that year. At the present time, an effort is being made to carry on special membership campaigns in the various Sections, leading up to the date of their annual meeting. There is every good reason to expect that a further substantial increase in total membership will occur before the end of 1937.

The Highlights of the Buffalo convention were—so many it is hard to select. The Los Angeles quartet, the fine reports of various Water Works Practice committees, the All-Division dinner, the Ohio flood symposium, the Niagara Falls trip, the panel discussion on Gastro-Enteritis, the Finance and Accounting Division luncheon, the Water Softening symposium, the largest-ever Golf Tournament, the fine Exhibits —these and many other items all went to make a convention unprecedented in size and enthusiasm. Old acquaintances were renewed; new ones made; new ideas acquired; old ideas modified. It was a convention in every sense of the word. To W. W. Hurlbut and his quiet efficiency goes credit for a fine job as President. To Eugene Dugger as our new President goes the Association full of spirit to go forward aggressively and enthusiastically and maintain its place in the arena of technical-trade associations. Three cheers for Buffalo! On to New Orleans!

(*Continued*)

UNIVERSAL PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

THE CENTRAL FOUNDRY COMPANY

General Offices: 366 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1629 Wellington St. - OAKLAND, CALIF., 278 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

ZEO GREENSAND ZEOLITE

FOR WATER SOFTENING AND IRON REMOVAL

Zeolite Chemical Company, 144 Cedar Street, New York

IMPORTANT

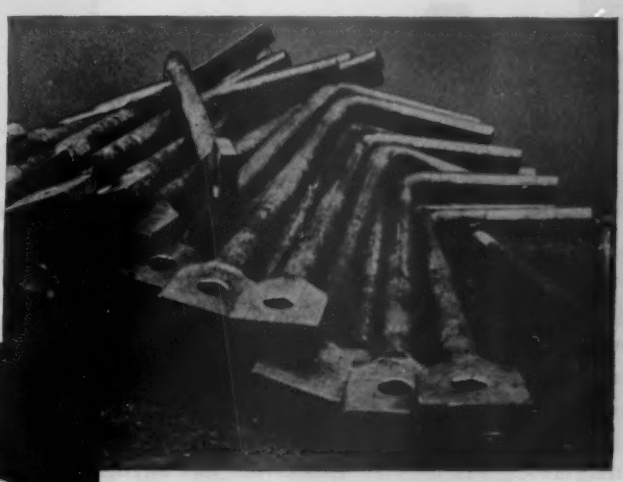
THE Association has run short of certain numbers of the Journal. Any members who do not desire to preserve their copies of the following issues and are willing to return same, will be acting to the benefit of the Association.

AMERICAN WATER WORKS ASSN.,
29 W. 39th St., New York, N. Y.

January and March,	1920
January and March,	1922
January, March, May, July, and September,	1924
All issues for	1926
January, February, March and April,	1929
January, February, March, April and May,	1930
April,	**1936**
January, February, March,	**1937**

ANACONDA

EVERDUR lug bolts for Brookside Reservoir, Morristown, N. J.



FOR 10 YEARS

EVERDUR* has proved itself in water service

SINCE 1927, for spillway fittings, bolts, steps and valve stems, etc., EVERDUR Metal has demonstrated that it has exceptional advantages.

Steel-like strength and high resistance to corrosion are of course of first importance. But in addition, EVERDUR Metal is fabricated so easily, and is so reasonable in cost, that it is acknowledged by many authorities to be in a class by itself for reservoir and water works service. EVERDUR is available in all commercial forms. Let us send you complete information. 5774

*"Everdur" is a trade-mark of The American Brass Company, registered in the U. S. Patent Office.

Everdur Metal

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

Offices and Agencies in Principal Cities • In Canada: Anaconda American Brass Ltd., New Toronto, Ontario

(*Continued from page 1*)

Iron removal and softening are beginning to receive much needed attention in Indiana. Within the past two years iron removal and softening plants have been completed at Lebanon, Crown Point, Bicknell, and Princeton. Construction work is about to begin on iron removal plants at Frankfort, Indiana, and the Indiana State Girl's School. Other plants are contemplated. Plants employing aeration, sedimentation, and gravity filtration for the removal of iron followed by zeolite pressure filters for softening are gaining favor. The January, 1937, flood was the greatest catastrophe ever visited on Indiana water supplies. All of the Ohio river supplies except Greendale, Rising Sun and Rockport, Indiana were completely disrupted. Pumping station failures were responsible in most instances. The city of Evansville has engaged consulting engineers and a report has been completed covering the changes necessary to protect the plant against another such flood. Water works expenditures in the state during 1935 and 1936 amounted to approximately three and one-half ($3,500,000) million dollars in addition to a great amount of main extension and minor plant repairs which were carried out by Works Progress

(*Continued*)

GENERAL STEEL PLATE CONSTRUCTION
GRAVER
TANKS
WATER CONDITIONING EQUIPMENT

Modernize

Prepare for expansion—look to the future. Check over present equipment. Bring it up to date. Let us work with you on designing, fabricating or erecting any kind of tanks, water treating equipment or steel plate work—

Send for Literature Today

GRAVER TANK & MFG. CO., INC.

75 Years of Dependable Service

New York, N.Y. East Chicago, Ind. Chicago, Ill. Catasauqua, Pa.

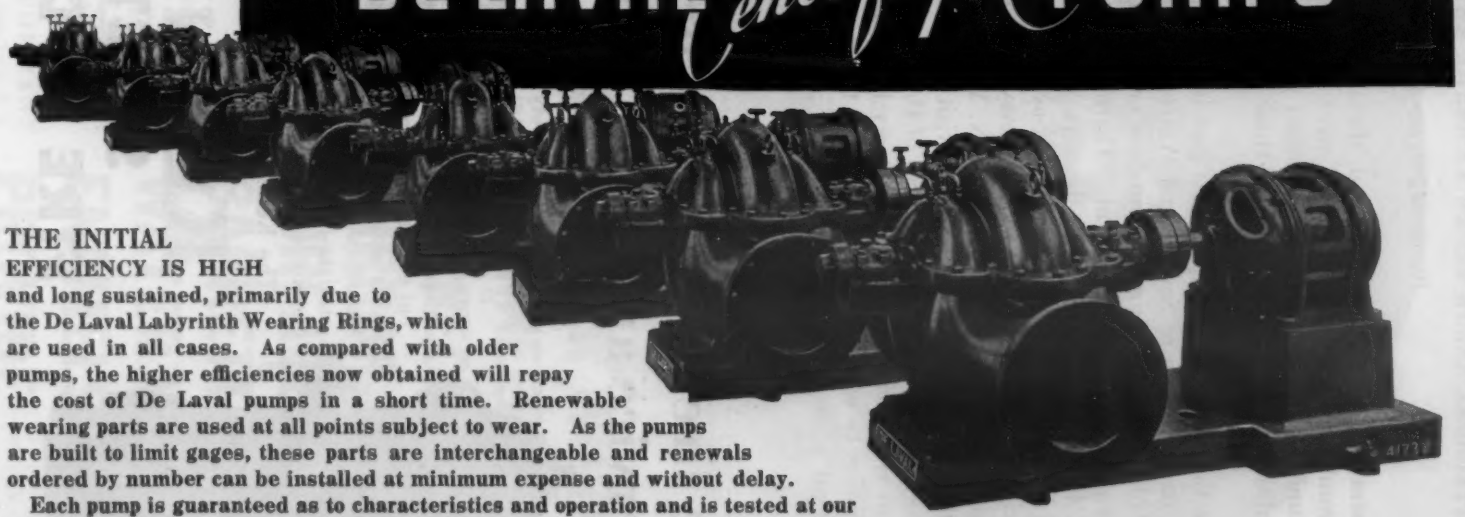
SETTLERS
FILTERS FOR MINERAL, TASTE, COLOR, ODOR REMOVAL
LIME AND SODA SOFTENERS
ZEOLITE SOFTENERS
IRON REMOVAL PLANTS
STERILIZERS

LOW TOTAL COST

of operation has been the objective in developing

DE LAVAL *Centrifugal* PUMPS

● De Laval 12 in. pumps to handle 2080 g. p. m. each of sludge containing one per cent of solids.



THE INITIAL EFFICIENCY IS HIGH and long sustained, primarily due to the De Laval Labyrinth Wearing Rings, which are used in all cases. As compared with older pumps, the higher efficiencies now obtained will repay the cost of De Laval pumps in a short time. Renewable wearing parts are used at all points subject to wear. As the pumps are built to limit gages, these parts are interchangeable and renewals ordered by number can be installed at minimum expense and without delay.

Each pump is guaranteed as to characteristics and operation and is tested at our Works.

DE LAVAL STEAM TURBINE COMPANY, TRENTON, N. J.

(*Continued from page 6*)

Administration. The Hammond and Michigan City, Indiana, filtration plants would probably be considered most noteworthy although many small municipalities have developed ground water supplies which are just as important in so far as the people of those municipalities are concerned.

The Carborundum Company has just issued an engineering bulletin (No. 1) on "Aeration of Sewage and Water." It is an interesting compilation of data concerning carborundum or "aloxite" diffusers for aeration in water and sewage treatment. There are sections on capacity and form of tanks, air requirements, blowers, air filters, piping, diffusers, pressure losses, installation methods, etc., as well as special discussions of the aloxite brand of diffusers. Copies may be had by addressing The Carborundum Company, Niagara Falls, N. Y. or Canadian Carborundum Co., Ltd., Niagara Falls, Ontario. A visit to the Carborundum Company was one of the valuable features of the Niagara Falls afternoon at the recent convention and an unexpectedly large number of the members took occasion to add to their knowledge of the material by an inspection of the plant where it is made.

(*Continued*)

The fire hydrant for present-day service and traffic conditions

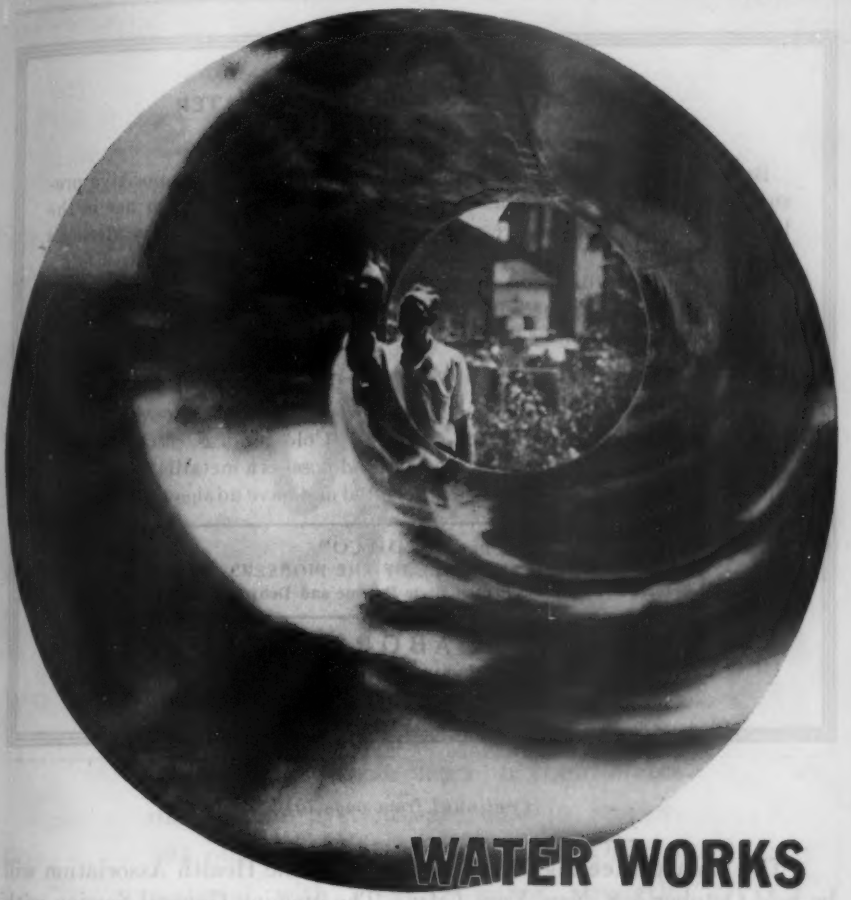
THE Kennedy SAFETOP meets every requirement of strength, safety and economy as well as instant readiness and reliability in service.

It is strong enough to resist any ordinary impact; but if broken by a collision which *no* hydrant could resist, it is speedily and economically returned to service, without excavation or shutting off the water supply.

Its easy elbow and nozzle curves and its extra-large standpipe assure minimum pressure loss; and its simple, straight-line operating mechanism assures positive operation without danger of sticking.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY
SAFETOP
REG. U.S. PAT. OFF.
FIRE HYDRANT



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WATER WORKS
ENAMELS

WATER WORKS ENGINEERS APPRECIATE THE MIRROR-LIKE SURFACE BARRETT WATER WORKS ENAMELS PROVIDE

FIELD SERVICE

The Barrett Company maintains a Pipe Line Service Department to assist engineers in all coating problems, and also has available Field Service men whose assistance is offered where Barrett's protective coatings are used. Inquiries are invited.

THE BARRETT COMPANY
40 Rector Street New York, N. Y.

DIFCO

THE DETECTION OF COLI IN WATER

Bacto-Endo's Agar

Bacto-Endo's Agar is a widely used medium for confirming positive presumptive tests of *Escherichia coli* in water. When prepared for use in the laboratory this medium corresponds to Formula II of "Standard Methods of Water Analysis." Upon plates of medium prepared from Bacto-Endo's Agar *E. coli* forms dark red colonies with a brilliant metallic sheen which color the surrounding medium. Organisms which do not ferment lactose do not alter the appearance of the medium.

Levine's Eosin Methylene Blue Agar

Medium prepared from this dehydrated product conforms in every way to that recommended in "Standard Methods." Colonies of *E. coli* developing upon the surface of this medium are dark and possess a metallic luster while those of *Aerobacter aerogenes* are wine colored and have no sheen.

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

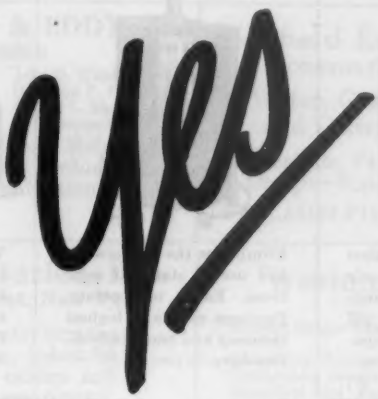
DIFCO LABORATORIES
INCORPORATED
DETROIT, MICHIGAN

(*Continued from page 10*)

The Annual Meeting of the American Public Health Association will be held October 5–8, New York City. The opening General Session with Dr. Parran, Mayor LaGuardia, Governor Lehman and Dr. Farrand on the platform promises to be an especially colorful affair, as does the Annual Banquet with Dr. McCormack, President-elect, the after-dinner speaker. There will be special sessions on Mental Hygiene, the Hygiene of Housing, and on Public Health Advancing. Among the subjects chosen for joint sessions are Nutritional Problems, with the Child Hygiene and Food and Nutrition Sections; Water-Borne Diseases, with the Public Health Engineering and Epidemiology Sections; the Crippled Child, with the Child Hygiene and Public Health Nursing Sections and Syphilis in Industry, with the Industrial Hygiene and Public Health Nursing Sections. The American Association of School Physicians, the National Organization for Public Health Nursing, the Federation of Sewage Works Operators, and several other allied national groups will join with the American Public Health Association in a series of scientific sessions.

(*Continued*)

204 OUT OF 212 CITIES SAY . . .



WE asked 212 cities whether the *original cast iron lines* in their water distribution systems are still in service. 204 out of 212 cities said yes. Only a material with great bursting strength, beam strength, crushing strength, impact strength and effective resistance to corrosion—the five indispensable requirements of an underground main—can render such enduring and economical service.

THE CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Bldg., Chicago

Proven **EQUIPMENT FOR THE WATER INDUSTRY**

MADE IN U. S. A.

HELLIGE COLORIMETRIC COMPARATORS

Equipped with solid glass color standards. The only permanently reliable standards for chlorine and pH control, and all other popular water tests.

HELLIGE TURBIDIMETER

Eliminates the preparation and use of standard solutions. Easy to operate. Produces results of highest accuracy and reads turbidities down to zero.

HELLIGE GLASS ELECTRODE pH-METER

The ideal outfit for accurate electrometric pH determinations with glass electrodes. Reads direct in pH. Rugged—extremely simple to use—attractively priced.

HELLIGE, INC. 3718 NORTHERN BLVD. LONG ISLAND CITY, N.Y.

(*Continued from page 18*)

Neoprene, an engineering material with rubber-like properties, yet one which resists the deteriorating effects of oil, heat, sunlight, chemicals and oxidation, is described in detail in a new handbook published by Rubber Chemicals Division, E. I. du Pont de Nemours & Company. This presentation considers separately the effects of various types of oils, acids, sunlight, heat and other forces which result in rapid deterioration of rubber products and indicates the type of service which may be expected with a similar part of neoprene.

Specific applications of neoprene, including hose, electrical cable, molded parts, extruded material, sheet goods and gaskets are also described, with data on reasons for the use of neoprene in these applications. Of special interest is a summary of the method of making neoprene and its chemical composition.

Three-quarters of a century ago, when many of the large containers for liquids were fashioned from wood, in the form of barrels or vats, the Graver Organization turned its attention to iron and steel containers. Oil was discovered about this time and the first Graver tanks, made in a

(*Continued*)

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Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.

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Sewerage and Sewage Disposal
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Water, Sewage, Drainage, Refuse and Industrial Wastes Problems
Laboratory, Valuations

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Water, Gas, Electric Plants and Distribution Systems

Appraisals, Valuations and Reports
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Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swiming pool control.

Chemists Field Sanitary Surveys
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Weston & Sampson

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Consulting Engineers for Water Supply, Water Purification, Sewerage, Disposal of Sewage, and Municipal and Factory Wastes, Operation of Purification Plants and Sanitary Analysis.

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Water Supply, Treatment, Sewerage, Reports, Plans, Estimates, Supervision and Operation
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Engineers

Water Waste Surveys
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Water Distribution Studies
Penstock Gaugings

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Specialties: Water Supply and Sewerage

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Telephone 5501 Cortlandt

Help Build up Your Association by Bringing in a New Member

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APPLICATION BLANKS

AMERICAN WATER WORKS ASSOCIATION

29 W. 39th St.
NEW YORK CITY

Trade Mark MABBS Reg. U. S. Pat. Off.

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(*Continued from page 22*)

small Pennsylvania factory, were used for oil storage. They were crude affairs, but substantial, long lived and very satisfactory.

Today Graver manufactures all types of steel plate structures and tanks of all sizes for any industrial or municipal purpose. They also make water treating equipment, Zeolite softeners, lime hydrators, Chlorinators and Swim-Pools. Graver plants are located in East Chicago, Indiana and Catasauqua, Pennsylvania, with sales and service offices in each industrial center.

The Water Works Manufacturers Association chose Clinton Inglee, National Water Main Cleaning Company, for President during the

(*Continued*)

YOUR DOLLAR'S WORTH IN A METER SETTING

It is just as much false economy to set a water meter in the cheapest way as it is to do the plumbing of a house in the cheapest way—

A water meter set in a Ford Yoke or in a Copperhorn Meter Coupling can be easily removed and replaced without disturbing the service pipe—

This one fact alone justifies what slight extra cost there may be—

THE FORD METER BOX CO.
Wabash, Ind.

Water Meter Setting and Testing Equipment

Ford Yoke for Setting on Risers

Straight Line Yokes for shallow meter box or basement settings in horizontal piping

Saves Couplings

Saves Fittings

Ford Copperhorn Meter Coupling

ADVERTISING

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BUSINESS

GRINNELL
. . . CHECK VALVES . . .

Uniflow Check Valves

Detector Check With Meter in By-Pass

◀ These all bronze special check valves have bronze clappers with special molded rubber facings. Made to specifications of, and approved by, Factory Mutual Laboratories.

◀ Used in pairs in public water service connections to private fire systems, they prevent water from a secondary source backing up in the public mains, thus eliminating danger of contamination.

◀ A "detector" device to guard against leakage or possible misuse of water in fire protection equipment.

◀ 2 inch by-pass and meter accurately measures water flows up to slightly over twenty-five gallons per minute, sufficient to indicate any flow of water for other than fire extinguishment.

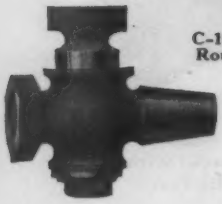
Conveniently located Grinnell Warehouses assure prompt delivery of all types of socket fittings in the wide Grinnell Line.

GRINNELL COMPANY
INC.
EXECUTIVE OFFICES PROVIDENCE, R. I.
Branch Offices in Principal Cities

KITSON

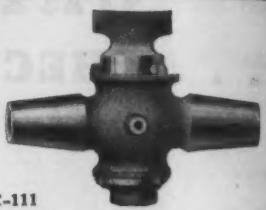
C-104—Solid Lever Roundway S. & W.

C-101—Solid Tee Roundway Stop



C-105 Solid Tee Roundway Stop—Lead and Iron

ROUNDWAY STOPS



C-111
Solid Tee Roundway Stop & Waste Lead Pipe

Write for details and prices. No obligation.

KITSON COMPANY
2409-15 WESTMORELAND STREET
PHILADELPHIA, PA.

Manufacturers of: Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.

(*Continued from page 26*)

coming year; H. W. Ford of Pittsburgh-Des Moines New York office as Vice President and re-elected Edgar Buttenheim, American City, and John A. Kienle, Mathieson Alkali, as Treasurer and Secretary, respectively.

The New England Water Works Association's officers-nominate for 1937–8 are: for President, Warren J. Scott, Director, Bureau of Sanitary Engineering, Connecticut State Department of Health, Hartford, Conn.; for Vice-President, Percy A. Shaw, Superintendent and Engineer, Water Works, Manchester, N. H.; for Director, Harold L. Brigham, Superintendent, Marlborough Water and Sewage Commission, Marlborough, Mass.; for Treasurer, Leland G. Carlton, Water Registrar, Municipal Water Works, 71 Kimberly Avenue, Springfield, Mass. The annual convention of the New England Association will be held at the Poland Springs House, Poland Springs, Me., September 21–24, 1937.

Wesley W. Polk, of Evanston, Illinois, has stepped up from the position of Superintendent and Chief Engineer of the Water Department to that of Commissioner of Public Works. Added to his former activities

(*Continued*)

TYPE M

MODEL D

REGISTER - INDICATOR RECORDER

New Model D Features:

1. Retention of previous sturdiness and simplicity plus numerous improvements in mechanism and general design.
2. Twenty-one inches of mercury differential capacity with powerful float actuation.
3. Wider measuring range.
4. No possibility of air trapping; air vents at highest points over mercury chambers.
5. Easily set up, adjusted, and placed in operation.
6. Long, separate Indicator dial at eye level; no "stooping."
7. Entire chart record of flow rate visible from front of instrument.
8. Six-dial Totalizer, 4½" diameter.
9. Chart and Totalizer driven by electric motor or mechanical clock movement, as selected.
10. Dials mounted in neat steel cabinet with modern "switchboard" effect. Wall or separate panel mounting possible.
11. Indicator and Totalizer dials of white pyralin and all dials *illuminated* from the interior. Main case finished in black and embellished with chromium strips. An addition to the appearance of any plant.
12. Chronoflo long distance transmitting and summation attachments now available.

Write for new Bulletin 291

VENTURI

"VENTURI"—Registered

BUILDERS IRON FOUNDRY
9 CODDING ST., PROVIDENCE, R. I.

Without a second thought, millions of people drink the water that flows from their faucets . . . that is served at their tables every day in the year.

They drink it without question because they know it is pure . . . because they realize that every possible precaution has been taken to safeguard household water against contamination.

That places a lot of responsibility on the waterworks engineer. And in turn . . . a heavy responsibility on the organizations whose business it is to supply the chemicals for treating water supplies.

General Chemical Company Aluminum Sulphate is manufactured under the most rigid technical control of quality. It is a product on which engineers can rely for strict uniformity of chemical and physical composition. It remains free-flowing . . . dissolves quickly and can be supplied in a wide range of grades and particle sizes.

Write for data on grades and prices of General Chemical Company Aluminum Sulphate.

General Chemical Company

Executive Offices: 40 Rector St., New York City

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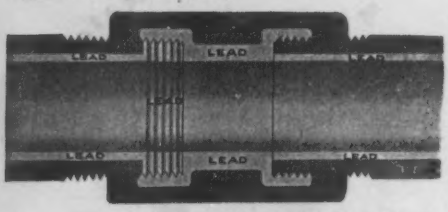
GENERAL CHEMICAL COMPANY

ALUMINUM SULPHATE

This shows Pipe just entering Lead Threads of Fitting



This shows Pipe Screwed into Lead Threads and Shoulders of Fittings

For Dependable Service Installations

"Wakefield Galvanized"

Amalgamated Lead Lined Iron Pipe and Fittings

Low Cost—Easily Installed—Permanent

Inquiries respectfully solicited

LEAD LINED IRON PIPE COMPANY
WAKEFIELD, MASS.

Are You Interested in Equipment for locating mains and services?

Write for a list
American Water Works Association
29 West 39th St. New York, N. Y

(*Continued from page 30*)

in charge of the water department are the control of the city streets. A graduate in Engineering from the University of Illinois, in the Corps of Engineers during the World War, successively with the City of Milwaukee and the Union Stock Yards of Chicago in water supply work, he has been in charge of the water department at Evanston since 1926. He is a member of several professional associations, including the American Water Works Association (since 1926) and is a Past Chairman of the Illinois Section of the A. W. W. A.

Abel Wolman, awarded the Diven Medal in 1937 for his outstanding service to the Water Works field, has accepted the professorship of Sanitary Engineering at Johns Hopkins University. He succeeds John H. Gregory, who died last January.

Mr. Wolman was a member of the first class in engineering graduated by Johns Hopkins and was awarded the honorary degree of Doctor of Engineering this year at the 25th anniversary of the Engineering School. From the date of his graduation up to the present time, Mr. Wolman has been associated with the Maryland State Department of Health and its Chief Engineer since 1922.

(*Continued*)

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
29 W. 39th Street, New York, N. Y.

Date:.....

.....hereby make application for.....Membership
(I or We) (Active, Corporate or Associate)
in the American Water Works Association, and enclose herewith the sum of

$.....the required initiation fee* and one year's dues in advance.

Name.....

Title or Business.....

Address.....

.....

.....

Business or Professional Experience .....

.....

.....

.....

.....

ARTICLE I OF BY-LAWS

Section 3. An Active Member shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Initiation Fee, $5.00; Annual Dues, $10.00.)

Section 4. A Corporate Member shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Initiation Fee, $10.00; Annual Dues, $15.00.)

Section 5. An Associate Member shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Initiation Fee, $10.00; Annual Dues, $25.00.)

Membership in the Association carries also membership in its Local Sections and National Divisions, and includes the Journal a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies.

* *Initiation Fee Waived During 1937*

(*Continued from page 34*)

He was Editor of this JOURNAL from 1922 to the end of 1936 and in that capacity established it firmly as a dignified and authoritative record of progress in water supply.

Under the recovery activities of the Administration at Washington, he has rendered distinguished service:—State P.W.A. Engineer for Maryland; regional P.W.A. Engineer for the southeastern United States; consultant to the Secretary of the Interior on water resources problems; and Chairman of the Water Resources Committee of the National Resources Board. In the conflicts of opinion regarding water supply conservation and development, members of Congress, as well as the parties to the various issues have grown to appreciate fully the clarity and integrity of his thought on these problems.

He has made frequent excursions into the educational field as lecturer on Sanitary Engineering and his assumption of the Chair of Sanitary Engineering in Johns Hopkins presages a stimulating experience for those who are his students.

Harrison P. Eddy, a kindly genial gentleman, an engineer of the type that is an inspiration to all engineers, an honor to his profession and honored by it, died in Montreal on June fifteenth. He had gone there to attend the jubilee meeting of the Engineering Institute of Canada, and was to have been made an Honorary member a few hours after his death.

He was born at Milbury, Mass. in 1870; graduated from Worcester Polytechnic Institute in 1891; and for fifteen years superintendent of the sewage treatment work at Worcester, Mass. In 1907, he became associated with Leonard Metcalf in the firm of Metcalf and Eddy. In his professional capacity he had acted as a consultant on sewerage, drainage and sewage disposal problems in such cities as Boston, Chicago, Cincinnati, Cleveland, Dayton, Louisville, Milwaukee, Pittsburgh, Portland. Ore., and San Francisco. He was a member of many associations devoted to engineering affairs, a past-president of the Boston Society of Engineers and a past-president of the American Society of Civil Engineers.

H. B. Stewart, Engineer of the Associated Factory Mutual Fire Insurance Companies, died on June fifth. He had been a member of this Association since 1925 and at the time of his death was serving on some of its technical committees.

NEWS OF THE FIELD

Where should A. W. W. A. headquarters be? Let's have some expressions of opinion from the membership of the Association. What is the function of the headquarters office of a technical-administrative association?

Imagine, for the sake of the discussion, that A. W. W. A. headquarters are now in Peaceful Valley, Any State. There is regular mail delivery and office facilities are satisfactory for handling routine correspondence. Any member who happens to be passing through that part of the country is a welcome visitor.

But there is a desire to make the location of headquarters mean the most that it possibly can in service to the Association as a going and growing concern. What factors should govern the choice of a location? Since the Association is technical in nature, a check should be made to see where good technical associations of somewhat similar field of interest are located. They should be helpful neighbors. Since the Association also has interest in public administrative and management problems, location of associations in this field should be investigated. Perhaps their problems and ours are similar. An exchange of ideas would help.

Since the advancement of the field requires coordination with and understanding of the equipment manufacturing field, consideration naturally must be given to the center where the leaders in this phase of the Association's interest may be found. Where is the center of gravity of membership? In what direction is substantial growth likely to occur? Obviously, there is little to be gained by getting headquarters too far detached for prompt mail service—and Association members do write a lot of letters. Where are the members likely to go when they are away from their home city? If headquarters can be located where the away-from-home member is most likely to go, some additional service can be rendered. Obviously, the city should be at the end of a standard travel lane, if possible.

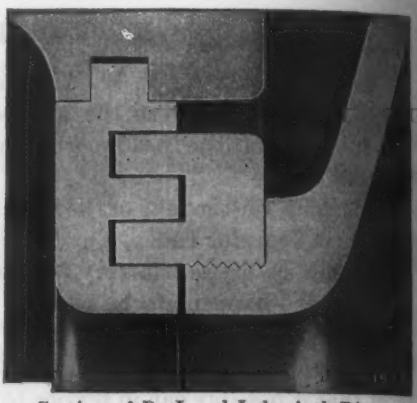
How permanent is the Washington "emphasis" going to be? Are enough of the continent's major plans and programs, as they touch municipal activities, to continue to be affected by federal policies to justify the location of headquarters there? On the other hand, do enough of our members dislike the "New York" influence to operate against that city as headquarters, even though other advantages exist? These and other minor factors should govern the intelligent choice of headquarters for such an organization as the A. W. W. A.

(Continued)

LOW COST PUMPING

Ten million gallons per day aggregate capacity of DE LAVAL PUMPS

are installed in American water works pumping stations. The reason why is to be found in low overall cost per gallon pumped, resulting from:



Section of De Laval Labyrinth Rings

1—**HIGH INITIAL EFFICIENCY,** obtained by correct hydraulic design, and by reduction in leakage through the use of labyrinth wearing rings, without resort to close running clearances;

2—**SUSTAINED EFFICIENCY,** since labyrinth wearing rings, having larger clearances and less leakage, give longer life than do flat wearing rings;

3—**LOW MAINTENANCE EXPENSE,** horizontally split casings, make all parts easily accessible, due to interchangeability based on manufacture to limit gages, so that parts subject to wear, such as wearing rings, shaft sleeves, casing protecting bushings and bearings, are readily replaced by new parts, without fitting;

4—**POWER LIMITING CHARACTERISTIC,** which obviates the need of over-size motors, makes possible higher efficiency, higher power factor, and, in many cases, lower rates for current;

5—**RESPONSIBLE GUARANTEES,** of efficiency and head-delivery characteristics and of perfect mechanical operation, all certified by actual test before shipment from the Works.

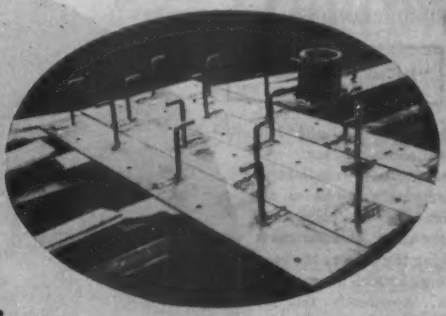
DE LAVAL STEAM TURBINE COMPANY

Trenton, New Jersey

Manufacturers of Steam Turbines, Centrifugal Pumps, Propeller Pumps, Motor Mounted Pumps, Rotary Displacement Pumps, Centrifugal Blowers and compressors, Worm Gears, Helical Speed Reducing Gears, Hydraulic Turbines, Flexible Couplings. Sole Licensee of the Bauer-Wach Exhaust Turbine System.

2531

For screens
Screen frames
Spillway fittings
Bolts
Valve stems, etc.



Non-Rust **EVERDUR** *Metal*
(STRENGTHENED COPPER)

ANACONDA METALS offer a permanent solution to corrosion problems, say the many engineers who have tried them.

EVERDUR* METAL is *rustless as copper... strong as steel... readily welded.* Since 1927, this durable copper-silicon alloy has demonstrated its value in many phases of reservoir and waterworks service.

ANACONDA COPPER TUBES put an end to the search for durable, trouble-free, cost-free service lines. They are ductile and easy to install . . . no threading.

Anaconda Copper & Brass

THE AMERICAN BRASS COMPANY • *General Offices:* Waterbury, Conn.

*Trade-mark Reg. U. S. Pat. Off. *Offices and Agencies in Principal Cities* 37400

SUBSTANTIATED IN SERVICE

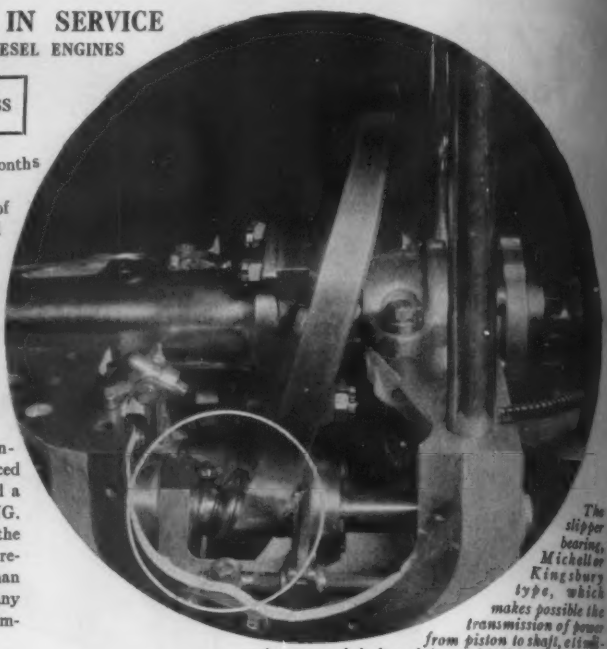
STERLING CRANKLESS DIESEL ENGINES

Built under "MICHELL CRANKLESS ENGINE" patents

Quotation of report after 7 months of continuous running:

"Micrometer readings of bridge bushings, pistons and cylinders gave no evidence of wear, these measurements showing the same as the new parts with which I compared them. Apparently this is due to the absence of side thrust on the cylinders, and the fact that these engines burn the fuel oil cleanly.

"The longer I have these engines the more I am convinced that I could not have installed a better engine than STERLING. My experience in removing the piston for inspection and replacing it convinced me more than ever that the Sterling Company has gone a long way toward simplifying maintenance."



The slipper bearing, Michell or Kingsbury type, which makes possible the transmission of power from piston to shaft, eliminating a crankshaft and its multiplicity of bearings.

STERLING ENGINE COMPANY

Dept. C-3

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

Branch Office
900 Chrysler Bldg.
New York, N. Y.

(*Continued from page 1*)

Taking up the factors in order, the major technical associations will be found headquartered in New York, with Philadelphia, Washington and Chicago each having their group centers. Public administration associations center in Chicago, with Washington and New York following. The water works equipment field centers in New York, with Philadelphia, Pittsburgh and Chicago following. Membership density appears to center near Pittsburgh. Members away from home will touch Washington, New York and Chicago most often, but the west coast attracts many of them in recent years. Who knows how permanent the "Washington" influence is, or how unpopular "New York" with its Wall Street and/or Union Square may be?

So take your pen in hand—and write a letter to A. W. W. A. headquarters. Tell where you think it should be located and why you think so. No awards. No prizes. No inducement whatever other than the pleasure of expressing yourself on a subject in which you are interested and in which your headquarters staff is vitally concerned.

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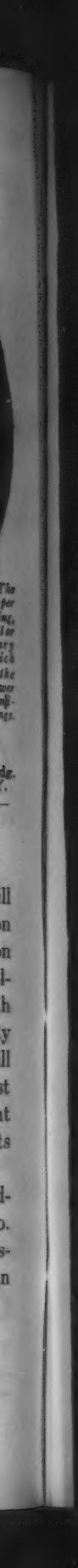

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98% Pure Silica

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Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY

Silica Mines

THOMASVILLE, GEORGIA

√Check LUDLOW Hydrants

Check these points about the Ludlow No. 90 hydrant—

√ Full force—no obstruction in waterway

√ Non-freezing—drains from bottom

√ Surge and water hammer eliminated

√ Replaceable without digging

√ Parts easily removable—low maintenance

—and finally, the most modern, graceful design obtainable. Send for free folder.

The LUDLOW VALVE MFG. CO.
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EDSON DIAPHRAGM PUMPS

Hand Operated—size 2″, 2½″, 3″, 4″
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Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

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Why take LESS than these Advantages?

● Only in MINERALEAD do you get the INGOT form, so easy to store and handle—*plus* Assurance against change in composition en route to the job—*plus* Safety against rain and flood—*plus* No Delays when you add more to the melting pot.

● To these advantages add joints permanently tight and with ample reserve strength to stand heavy vibration.

● Write for folder and further information.

The ATLAS MINERAL Products Company of Pa.
MERTZTOWN, PENNA.

MINERALEAD

(*Continued from page 6*)

The National Fire Protection Association Quarterly for July, 1937 carries the report of the recent annual meeting at Chicago. It contains reports on Static Electricity, Hazardous Chemicals, Spontaneous Heating and Ignition, Prevention and Control of Dust Explosions, Hose Couplings and Nozzles, as well as a wide variety of papers and discussions on problems related to lessening of fire losses.

The total recorded fire loss in the United States in 1936 was $263,259,746. Among the cities over 500,000 population, the lowest 5-year average per capita loss was $0.71 in Washington; the highest was $3.46 in Boston. Among all the cities from 20,000 to 500,000 population, the lowest five year rate was that of Jersey City—$0.36; the highest, that of Peoria—$8.10. In the latter case, the average would have been much less had it not been that the loss in 1935 was $31.93 per capita.

Canadian fire losses for 1936 totalled $21,549,484. The average per capita loss was $1.95, with the highest rate—$4.98—in villages under 1,000 population. Among British cities, Edinburgh topped the list for 1936 with a $4.61 per capita loss; Brighton had the lowest loss—$0.13 per capita. On the continent, Vienna's loss was only $0.09 per capita, but

(*Continued*)

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One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

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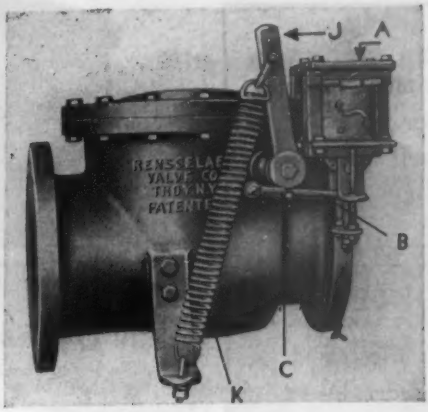

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CHECK VALVES

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ELIMINATE SLAM
REDUCE WEAR ON WORKING PARTS

A swing type Check Valve with Bronze Lifting Cylinder —Lifting Arm—Four-way Valve—Lever Arm—closing spring and a combination holding and releasing solenoid.

Made in two designs. The STRAIT-THRU type and the INCREASING TYPE (Inlet one diameter and Discharge another diameter.)

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JOSEPH DIXON CRUCIBLE CO.
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DIXON'S INDUSTRIAL SILICA GRAPHITE PAINT
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(*Continued from page 10*)

Stockholm's was $5.25. The latter city's rate goes to show that firemen do still have something to do even in Europe.

Recent developments have tended to focus attention on the management of cash resources in business. Many executives, faced with the problem of paying out a higher portion of profits either in dividends, taxes, or both, have gained a new appreciation of the value of the cash budget. The special timeliness of this subject led the Policyholders Service Bureau of the Metropolitan Life Insurance Company to conduct a survey of the practices followed by 45 companies in budgeting their cash requirements. The results of the investigation have been published in a report entitled "The Cash Budget."

The cash budget is utilized primarily as a guide to major financial policies and as a basis for carrying out the financial program. The Bureau's report cites specific methods of utilizing the cash budget as reported by the 45 concerns contributing to the survey. Twenty industries are represented. The report also discusses the scope of budget activities and outlines the sources used in the preparation of cash forecasts.

(*Continued*)

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makes the housekeeping bills of every citizen smaller

● Soft water saves soap, and lots of it. It saves wash clothes and linens from being frayed out by hard water scrubbing. It saves plumbing repairs and hot water coil replacements. It saves fuel in hot water heating. It saves coffee—soft water requires less.

These items add up. Figures show that the average family using hard water can save over $100 per year with soft water.

Your community not only needs soft water, but can afford it. A Permutit Zeolite Municipal Water Softening Plant is moderate in cost, inexpensive to operate and maintain. Works with water of any hardness. If, in addition, your local water requires treatment to remove bad taste, iron, corrosive qualities or dirt, Permutit will handle that, too.

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Sizes 2" to 84"

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Special Castings ***Short Body B. & S. Specials***

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

(*Continued from page 12*)

The majority of contributing companies provide for both a short-term and a long-term forecast of their financial positions. One section of the report is concerned with the question of responsibility for forecasts; another with the use of the daily cash report. The appendix presents an excerpt from the budget manual of one company covering standard instructions for the preparation of cash forecasts. The report is freely illustrated with budget forms and records in current use. Readers interested in this subject may obtain copies of "The Cash Budget" from the Policyholders Service Bureau, Metropolitan Life Insurance Company, 1 Madison Avenue, New York, N. Y.

The Public Health Engineering Section of the A. P. H. A. will have a busy program during the New York Convention, October 5th to 8th. The Thursday morning session is of special interest to water supply men, —a joint meeting with the Epidemiology Section to discuss "Explosive Outbreaks of Gastro-Intestinal Disorders with Particular Reference to Transmission by Water Supplies." The engineers' stag dinner on October 6th will be guided by the master hand of Bill Orchard.

(*Continued*)

"Hot as H . . . !"

● HOT AS HADES: Every year during this period, heat waves bring about the usual run of troubles for Mr. Plant Operator.

1. Low water conditions, or actual shortage of raw water.

2. Excessive algae and other organic growths in raw water supplies, resulting in excessive tastes and odors.

3. Reduced turbidity in the water supply, making coagulation difficult and shortening filter runs.

4. Greater increased consumer demand.

In a paper read by E. A. Sigworth before the 4-States Section Meeting of the American Water Works Association, Philadelphia, Pa., April 22-24, 1937, a cross section of returned Questionnaires indicated that hot weather was the period in which tastes and odors predominate.

This means that the Plant Operator is confronted with his greatest problem during this period and is particularly "pushed" to the limit to furnish a water that is palatable. One means of helping with this problem is the application of AQUA NUCHAR as an aid to better coagulation, and for its all around use as a taste and odor remover.

POWDERED ACTIVATED AQUA NUCHAR CARBON

"MAKE YOUR PLANS NOW TO ATTEND THE ANNUAL CONVENTION OF THE SOUTHWEST SECTION OF THE AMERICAN WATER WORKS ASSOCIATION TO BE HELD OCTOBER 18-21, 1937, AT THE HOTEL DRISKILL, AUSTIN, TEXAS."

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on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

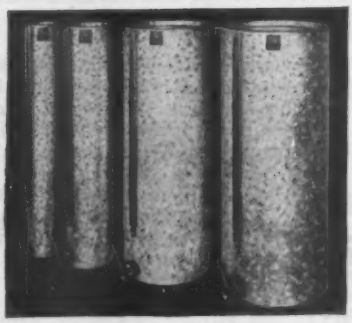
MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(*Continued from page 14*)

The new Deep Well Turbine Pump Section of the Hydraulic Institute Standards has just been published. It includes definitions of Deep Well Turbine Pump Parts and Materials; conditions of sale; definitions of efficiencies and methods of testing; what to look for in the event of pumping troubles; charts and explanations of column friction losses and mechanical friction in turbine pump line shafts; description of power balance in a deep well turbine pump; air line method of determining depth of water level and method of plumbing a well. Price of this section is 25 cents or it will be furnished with the complete book of Standards which is priced at $1.00. Copies may be had by addressing the Secretary, C. H. Rohrbach, 90 West Street, New York, New York.

(*Continued*)

Ford Calibrated
TESTING TANKS



These tanks are made in four sizes. They are heavily galvanized and provided with percentage calibration, gauge glass and quick-opening drain valve. Simple and easy to use. Hundreds in use. Write for information.

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Write for a list
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FROM the olden days comes the saying "Products of Specialists Have Always Been Preferred". So it is today. Activated Alum Corp. Specializes in the Production of Chemicals for Coagulation Purposes.

1. **BLACK ALUM**—(Carbon Compounded Sulphate of Alumina)—18% Alumina For Taste and Odor Improvement.—3% Activated Carbon Admixed.
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May We Send You Samples of "All Three"?

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OFFICE
80 Broad Street
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WORKS
Curtis Bay
Baltimore, Maryland

(*Continued from page 16*)

The report of the Public Works Congress at Toronto last fall sets a new high standard for this annual. In addition to the excellent papers on various aspects of such ever-present public works problems as sewerage and sewage disposal, water supply, traffic safety, streets and roads, a lively and informed panel discussion on street sanitation services should prove most valuable. Also, a fine symposium on current municipal problems vividly sets forth the widely varying nature of public works activities in cities today. The volume (Public Works Engineer's Yearbook, 1937. $3.00) has the distinction of being the first to bear on its title page the name American Public Works Association (850 E. 58th St., Chicago) as publisher, for it was at this Congress that the former American Society of Municipal Engineers and the International Association of Public Works Officials voted to join forces in the formation of the new Association.

Election of Frank T. Sheets as president of the Portland Cement Association, effective September 1, was announced here today by Charles L. Hogan of New York, chairman of the Board. He succeeds Edward J. Mehren, who resigned last month to take care of his personal interests.

(*Continued*)

Why your community Should have SAFETOPS

MINIMUM pressure loss provided by extra large standpipe and smooth easy elbow and nozzle curves.
Maximum reliability assured by simple, straight-line operating mechanism and special long-wearing valve and gasket materials.
Minimum repair expense secured by the unique Safety Breakable Section. When struck by an impact which *no* hydrant could resist, this section parts cleanly, protecting the major and expensive portions of the hydrant from damage. The hydrant can be returned to service by one man, within half an hour, without excavating or shutting off the water pressure, and with parts costing only $6.00.
Maximum convenience obtained by ease of adjustment of working parts, nozzle positions, lubrication, etc.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT
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Recommended by the foremost pump builders

U. S. VERTICAL UNICLOSED MOTOR

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THE STANDARD
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WATER WORKS SPECIALTIES

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Automatic Pressure Control Valves

Pressure Reducing-Altitude

Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.

(*Continued from page 18*)

Mr. Sheets for the past four years has been consulting engineer and director of development of the Association. Prior to that time he had been associated with the Illinois Highway Department for twenty-three years and for twelve years as superintendent of highways and chief engineer. He is the author of "Concrete Road Design, Simplified and Correlated with Traffic" presenting sound and simplified methods of designing pavements to meet traffic expectancy. He has, during the past few years, directed the administrative and technical policies of the Highways Bureau of the Association, and has directed industrial research to develop new and improved uses of portland cement and concrete.

The ninety-fourth meeting of the American Chemical Society will be held in Rochester, N. Y., September 6th to 10th. Seventeen professional Divisions of the Society and the Micro-chemical Section have scheduled sessions. Dr. E. R. Weidlein, director of the Mellon Institute of Industrial Research, Pittsburgh, will deliver the annual presidential address of the Society.

(*Continued*)

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Interchangeable parts

from Passaic Consolidated Water Co. Set in Service Mar. 20, 1899

New parts make Old Trident Meters New

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OVER 6 MILLION TRIDENT & LAMBERT METERS
MADE AND SOLD THE WORLD OVER

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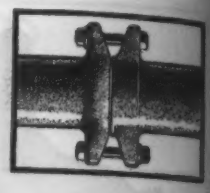

No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

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FOR WATER SOFTENING AND IRON REMOVAL

Zeolite Chemical Company, 144 Cedar Street, New York

(*Continued from page 20*)

At twenty-three symposia, special reports of developments affecting industry, nutrition, public health, pure science, and education will be presented. Artificial radioactivity and its chemical uses, studies of the chemistry of the earth's crust, low temperature methods and research, chemical microscopy, quantitative spectroscopic analysis, and photography will be among the session topics of the Division of Physical and Inorganic Chemistry. The National Research Council's Insulation Committee will join with the Division in a symposium on the chemistry and physics of electrical insulation. Medicinal patents, vitamins, and the chemistry and metabolism of fats will be considered by the Divisions of Agricultural, and Food, Medicinal, and Biological Chemistry. The Cellulose Division will emphasize research on cellulose derivatives, while the Paint and Varnish Division will feature organic plastics.

Two days will be devoted by the Gas and Fuel Division to "Gaseous Combustion," during which will be covered the kinetics of ignition, flame propagation, inflammation limits, internal combustion engines, problems in fuel rating, and the state of the burned gas.

(*Continued*)

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Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swiming pool control.

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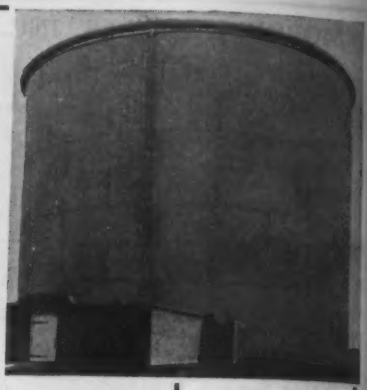

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LIME AND SODA SOFTENERS

ZEOLITE SOFTENERS

IRON REMOVAL PLANTS

STERILIZERS

(*Continued from page 22*)

Water supply of the city of Spokane, Washington, will be increased 60 million gallons a day under a water development program it has planned for more abundant and better municipal water. This enormous volume of water will be pumped by Pomona Pump Company pumps from wells of the caisson type which are sunk to very productive water strata. The first in this development was the Ray street pumping station at the corner of Ray street and Hartson avenue. The ultimate capacity of this station is four pumps of the deep well turbine type each to deliver 7500 gallons per minute, against a head lift of 420 feet. The second now in course of construction, the Hoffman street pumping station, is for two deep well turbine pumps, each to deliver 6100 G. P. M. at a total head lift of 340 feet, with 600 horsepower motor.

For both of these pumping stations the city has chosen Pomona pumps and at the Ray street station has installed two of the largest and most powerful deep well turbine pumps on record. Each of these units is comprised of a 6 stage Pomona, 24 inch medium capacity, turbine pump with 20 inch discharge column and 4 inch line shaft in 10 foot sections. This is driven by a Pomona Standardized 1000 horsepower, 20 inch surface

(*Continued*)

From MONSTERS TO MIDGETS — *the Valves you need*

Need a monster valve similar to those shown above? We'll make it for you. Need any size of valve down to a one-eighth inch midget? We have them ready to ship to you.

You can get the design of valve you require—globe, gate, check, plug disc, motor-operated, etc.

You can have the metals, alloys or combination of metals necessary to give you the best service—brass, bronze, cast iron, malleable iron, forged steel, cast steel, and a wide range of alloys.

You can also get piping accessories of many kinds, fittings, fabricated piping and pipe.

You will find that there is regular CranEquipment for practically every service. Standardize on it. You will save time, money and get the best products available. See your Crane No. 52 catalog for details of 38,000 items, tested in the laboratory and proved in the field. Use it to CranEquip for satisfaction.

SEE OUR EXHIBIT AT THE NEW ENGLAND WATER WORKS ASSOCIATION CONVENTION, SEPTEMBER 21-23

CRANE

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Branches and Sales Offices in One Hundred and Sixty Cities
VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

...plied in the next few days.

World's Largest Sewage Plant CranEquipt

CHICAGO, ILL., Aug. 6 — At Stickney, Illinois, the Chicago Sanitary District is building the largest sewage treatment plant in the world.

The discharge control valves on the four sewage pumps, each having a normal pumping capacity of 18,000 cubic feet of sewage per minute against a 54-foot head are 66-inch motor-operated Crane gate valves, one for each pump. These are not the largest Crane valves in the service of the city of Chicago, nor the smallest, as Chicago has been a big user of CranEquipment since the early days of Crane.

They are typical, however, of Crane's ability to design valves for a unique problem in the waterworks and sewerage fields. Valves of this size are not required on every installation, but when desired, they are obtainable in the same high quality and precision of performance typical of all Crane valves.

Waterworks and Sewerage CranEquipment

Crane makes a great number of valves and fittings for use in city service. It also makes a line of sluice gates and other piping accessories. Turn to your Crane No. 52 Catalog for the details about 38,000 items. Among them you will find an answer to practically any problem which you may have. You will also find a large amount of engineering data which may prove very desirable to have handy. Use CranEquipment. It will serve you well.

(*Continued from page 26*)

discharge, electric Unidrive head into which is built a Westinghouse 90 H. P., 2300 volt, 3 phase, type CW wound rotor, "slip ring" motor, operating at 1175 revolutions per minute.

The Division of Simplified Practice of the National Bureau of Standards has announced that printed copies of Simplified Practice Recommendation R38–37, Sand-Lime Brick, are now available. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for five cents each. The recommendation, which was originally effective July 1, 1925, provides for one standard size of sand-lime brick having a length of 8 inches, width of $3\frac{3}{4}$ inches, and thickness of $2\frac{1}{4}$ inches. The revised recommendation retains the original dimensions of the standard size brick, and adds a tolerance of $\frac{1}{4}$ inch on length and $\frac{1}{8}$ inch on thickness and width. This recommendation is effective from June 15, 1937, and is subject to regular review by a standing committee of the industry.

For many years the American Society of Municipal Engineers had as one of its major activities the formulation of Standard Specifications for the construction of various types of municipal improvements. The present work is a revision and assembly of those specifications, as of 1936, published by the American Public Works Association, formed by the consolidation of the American Society of Municipal Engineers and the International Association of Public Works Officials. These specifications are intended to serve the public works engineer as guides or models for the preparation of actual contract specifications. They are not intended to be incorporated bodily in any set of contract documents. Local conditions, with which only the engineer responsible for a specific project can be familiar, must always be given full consideration and the specification modified accordingly when necessary. However, when used as guides, these specifications will enable the engineer to be confident that no essential item is overlooked and that the materials and construction methods specified conform to good practice.

The present edition consists of twenty-two specifications in the field of street paving. There are nine dealing with pavement foundations, two with sidewalks and curbs, one with brick pavements, one with stone block pavements, and nine with bituminous pavements. The specifications for portland cement concrete pavements and for sewer construction are now being revised and will be given publication in the same format in the near

(*Continued*)

13 CONTRACTS TO ALCO TO FURNISH STEEL WATER PIPE FOR THE NATION'S CAPITAL

Approximately 15,000 ft. of 30", 36" and 48" Alco Steel Pipe for the District of Columbia Water Department

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A *dozen* repeat orders for Alco Electric Welded Steel Pipe have been received from the District of Columbia since the first installation in 1932. This preference, however, is not confined to Washington, D. C., for water works engineers everywhere heartily indorse these

SPECIFIC ALCO FEATURES

- Greater Strength
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- Smoother Waterway
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Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

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DIVISION OF AMERICAN LOCOMOTIVE COMPANY

(*Continued from page 30*)

future. The format of this edition is entirely new, designed to facilitate revision and extension of the series. The pages are printed on one side only, and punched for a standard loose-leaf binder (price complete, $4.00). The special edition, which is available to public libraries only, is supplied with binder and includes service of new specifications as published, and revisions.

Frank C. Hopkins, a member of the American Water Works Association since 1919, died on July 4th, following a cerebral hemorrhage. He was associated with the Utica Consolidated Water Company from 1904, and its President for the eleven years until 1933 when he resigned. His later activities were with the Citizens Casualty Company of New York, although he continued as Chairman of the Board of the Water Company.

Frank P. Larman, chief engineer of the Illinois Water Service Company, died on June 3rd at his home in Champaign. He was a graduate of Rensselaer Polytechnic Institute (1900) and had been associated with various water works properties, notably at Utica, N. Y. and Omaha, Nebr., before going to Illinois. He had been a member of this association since 1914. Many people today, in the various cities where he had worked, enjoy the fruits of his engineering skill.

Arthur L. Reeder, recently an associate of Morrell Vrooman in the design of a filtration system for Gloversville, N. Y. died on May twenty-fourth. He had been a member of the Association since 1926 and was known to many of its members associated with filtration and treatment of water.

Charles Brossman, of Indianapolis, one of the organizers, in 1908, of the Indiana Water Supply Association and a member of this Association since 1916, died of a heart attack on June 30th. For many years he had been a consultant on mechanical and sanitary problems of water plants and he leaves many satisfactorily operating plants as monuments to his engineering skill.

Brossman was a former chairman of the Indiana Section of the A. W. W. A. and was for many years the secretary of the Indiana Engineering Society, now the Indiana Engineering Council. He was a genial man among men, possessing qualities of companionship that gave him a host of friends in all walks of life.

Frank A. McInnes, of Boston, a member of this association since 1914 and a consulting engineer of repute in New England, died on August 12th.

NEWS OF THE FIELD

A. E. Griffin, of the Wallace-Tiernan organization, crashes through with an idea that the Association should promote exchange of ideas among its members who have hobbies. His first idea is that we find a way to get in touch with each other the men who take an active interest in fresh water biology. Hawley of Fort Worth is well known to many of our members for his micro-movies. There is a man whose hobby for fresh water biology has developed on a grand scale. But there are a lot of men over the country who find themselves fascinated by the minute proletariat of their raw water. Any man who has taken more than a casual glance at such a sample through a medium-powered microscope remembers that he went back to his routine duties with an effort. There are members of this association who study such organisms, not simply as interferences to filtration that must be counted, but as things to be studied, classified, cultivated with the zest of a collector.

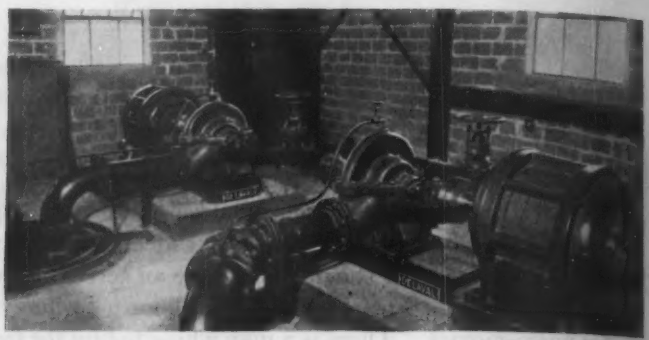
Such a hobby needs a further outlet in an opportunity to exchange ideas—specimens, too, if the opportunity offers. One man in the field has never forgiven himself for letting get away from his specimen aquarium a colony of fresh water jellyfish. Few people have even heard of them. They are as interesting an aquarium group as the Scalare or the Betta. Ask any tropical fish fan about those fish.

Right there is another hobby that has a real meaning to the water works man. The operators of modern purification plants know how many times in the course of a year customers call up to complain—not about pressure, or water bills, or taste or other things that might be considered actually important—but to lament the demise of the family goldfish. "What's the matter with the city water—our fish died?" Try laughing it off and you do a bad job at public relations. Be ready to discuss your own aquarium and the habits of fish as you have learned them. It is distinctly worth the trouble. More than one fine laboratory on the continent has its collection of tropicals and goldfish to observe and to understand well enough to talk intelligently to the customers who complain.

And, coming back to the point of all this discussion, the men in the field who take an interest in "parlor" fish would no doubt be glad to set up an exchange of ideas through correspondence.

The Chicago Section of the Chemical Society has an unusual camera show by and for its members. Prize winners have included some amazingly interesting shots of laboratory equipment, crystal structure and whatnot which not alone are of interest professionally but afford an outlet

(Continued)



Efficient PUMPS FOR CONTINUOUS PUMPING . . .

IN pumping 24 hours per day, power is the principal expense and sustained high efficiency results in decisive economy. The efficiency of each De Laval pump is guaranteed and demonstrated by actual test.

Overall efficiencies, including motor, of 88% have been certified in public acceptance tests.

The original efficiency of a De Laval pump is sustained, often for many years, principally because of the De Laval Labyrinth wearing rings. Parts of a De Laval pump subject to wear are readily replaceable, as all parts are interchangeable on a limit gage basis.

The two De Laval centrifugal pumps shown above each supply 700 Imp. gal. per min. against 135 ft. head to a gold mining plant, and a third pump supplies 500 Imp. gal. per min. against 100 ft. for cooling air compressor cylinders.

DE LAVAL STEAM TURBINE COMPANY

Trenton, New Jersey

Manufacturers of Steam Turbines, Centrifugal Pumps, Propeller Pumps, Motor Mounted Pumps, Rotary Displacement Pumps, Centrifugal Blowers and compressors, Worm Gears, Helical Speed Reducing Gears, Hydraulic Turbines, Flexible Couplings. Sole Licensee of the Bauer-Wach Exhaust Turbine System.

3160

A PRETTY SCENE . . . . (*for the Artist*)
but **ANOTHER SOURCE of TROUBLE . . .** (*for the Plant Operator*)

ANOTHER source of worry to the Plant Operator is the high color caused by falling leaves in the raw water supply and during their decomposition the creation of a distinct taste and odor problem.

During the Fall period, rains flush out the swampy areas where stagnant water during the summer period has had an opportunity of leaching out the color from the vegetation. This contributes heavily to the color removal problem and to the accompanying intensified taste.

The solution of these problems lies in the application of increased coagulation dosage for color removal and NUCHAR for taste and odor removal.

The cost of furnishing palatable drinking water through the use of Activated Carbon is so negligible that every purification plant should consider its continuous use throughout the year.

Make your plans now to attend the Annual Convention of the Southwest Section of the American Water Works Ass'n to be held October 18–21, 1937, at the Hotel Galvez, Galveston, Texas.

INDUSTRIAL CHEMICAL SALES
DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 Park Ave. New York, N. Y.
417 Schofield Bldg. Cleveland, Ohio.
205 W. Wacker Drive. Chicago, Ill.

(*Continued from page 1*)

for the hobby that the Kodak built into one of the nation's greatest avocations. Why not a camera show at the A.W.W.A. convention?

Calvert at Indianapolis, Roos at Cairo, Maffitt at Des Moines, and doubtless many others have a lively interest in plantings to improve the appearance of water works property. Why not a water works-garden and shrubbery hobby group?

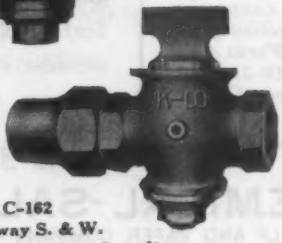
Let's give Griffin's idea a trial. Will any member who reads all this and who takes an interest in any of these things write headquarters and tell us his line of interest. As soon as "hobbyists" are known we will either by direct correspondence or through these columns, get them in touch with each other and see what can be done to promote their active acquaintance. By the way, does the Association include other amateur magicians in addition to Lloyd Nelson and Guy Northrop?

A Division of Water Pollution Control will be created in the Public Health Service of the Treasury Department in charge of a commissioned engineer officer of the Public Health Service if pending legislation passes when Congress reconvenes.

(*Continued*)

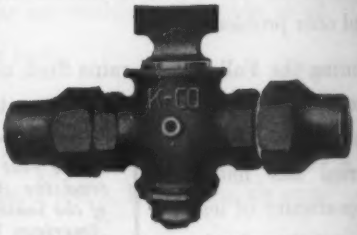
KITSON
FOR WATER WORKS

C-103 Roundway S. & W.
For Iron Pipe
Tee Handle



C-162
Roundway S. & W.
Inlet Copper Pipe Coupling
Outlet for Iron Pipe

PRODUCTS
STANDARD FOR 40 YEARS



C-164 Roundway S. & W. Copper
Pipe Couplings Both Ends

KITSON COMPANY
2409-15 WESTMORELAND STREET
PHILADELPHIA, PA.

Manufacturers of: Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.

38 SUPERINTENDENTS SAY:

Black Alum Wins!

NOW USED in 38 PLANTS IN 14 STATES

The increasing number of Superintendents switching to BLACK ALUM COAGULATION is recorded above—because ACTIVATED ALUM CORPORATION is proud of this fact—"THAT IN DOLLARS AND CENTS IN PLANT OPERATION BLACK ALUM PRODUCES THE BEST WATER"—

- Did you know that the new BLACK ALUM costs no more than the regular alum you are now using—
- Did you know that ACTIVATED ALUM CORPORATION also manufactures—

STANDARD BRAND ALUM
STANDARD ACTIVATED ALUM

May we send you samples of all three-

Activated Alum Corp.

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NEW YORK, N. Y.

WORKS:
CURTIS BAY
BALTIMORE, MARYLAND

(*Continued from page 4*)

In coöperation with the Chief of Engineers, with state or municipal agencies authorized to deal with water pollution, and with industries, the Division would prepare plans for eliminating or reducing pollution and improving the sanitary condition of the navigable waters of the United States and their tributary streams. These plans would give due regard to improvements necessary to conserve the waters, promote their use as sources of public water supply, for the propagation of fish and aquatic life, for recreational, agricultural and industrial uses. The Division would also encourage coöperative activities of the states for prevention and abatement of water pollution, encourage enactment of uniform state laws, the negotiation of compacts between the states (to which purpose Congress in the bill gives its consent), collect and make available information, results of surveys, etc., to states and municipalities.

States, municipalities, or other public bodies, discharging untreated sewage or waste into nagivable waters or their tributary streams would be eligible for federal aid in the form of grants-in-aid or loans for the construction of treatment works in accordance with plans approved by the state authority and the Surgeon General, the aid extended by the federal

(*Continued*)

EDSON

DIAPHRAGM PUMPS

Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

PIPE JOINTING MOVES
Smoothly and Swiftly with
this BETTER Compound

The 10 lb. ingots are easily handled and the actual work requires no skilled labor • The job moves along without delays when more compound is added to the melting pot • In case of rain, no tarpaulin or other protection is needed • Jointing with MINERALEAD is simple, easy and economical. No caulking required. Joints are permanently tight and vibration-proof.

• Write for folder and more information.

The ATLAS MINERAL PRODUCTS Company
of Pennsylvania
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MINERALEAD

for Jointing Bell & Spigot Main

MAINTAIN INITIAL CAPACITY

Pipe lined with Barrett Water Works Enamels will give long years of service at the same carrying capacity as at the time of the original installation. The mirror-like lining provided by these enamels retains its smoothness and offers exceptional resistance to moisture absorption and electrolysis. The result is an important contribution to operating economy.

FIELD SERVICE

The Barrett Company maintains a Pipe Line Service Department to assist engineers in all coating problems, and also has available Field Service men whose assistance is offered where Barrett's protective coatings are used. Inquiries are invited.

THE BARRETT COMPANY
40 Rector Street,
New York, N. Y.

(*Continued from page 6*)

government to be furnished on terms and conditions fixed by the Secretary of the Treasury and with the approval of the President.

This legislation, as the Vinson bill, passed the House on April 21st. No action was taken in the Senate until August 16th, when Senators Barkley and Lonergan, who had previously expressed opposing views concerning the form stream pollution legislation should take, joined in a substitute bill. One section charges the engineer board with the duty of fixing standards of purity (better termed "quality") for all navigable waters and their tributaries. The section immediately following declares it to be "against the public policy of the U.S. and a public and common nuisance" for anything solid, liquid or gaseous to be discharged into the navigable waters of the United States, or into "any tributary from which the same may flow, be washed, or carried into any of such navigable waters, in violation of regulations promulgated by the board, if such waste or other substance is or may be injurious to human health or to any other form of life, including aquatic life, or to migratory birds (as defined in the Migratory Bird Treaty of August 16, 1916) or impairs in any manner the utility of such waters for navigation purposes."

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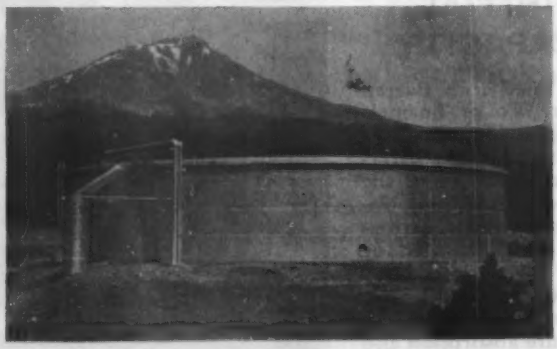

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We specialize in the design, fabrication and erection of heavy field-erected plate work of all types. Flat bottom water storage tanks similar to the one illustrated above are built in a complete range of standard capacities up to 180 feet in diameter —and in special designs to meet individual requirements. Write our nearest office.

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B-530

CITY OF NASHVILLE

OFFICE
SUPERINTENDENT
AND CHIEF ENGINEER
WATERWORKS DEPARTMENT
CITY HALL

ROBERT L. LAWRENCE, Jr.
SUPERINTENDENT
AND CHIEF ENGINEER

NASHVILLE, TENNESSEE
June 25-1937

Mr.Thomas F.Wolfe
Research Engineer
The Cast Iron Pipe Research Association
122 South Michigan Ave.
Chicago Illinois

Dear Sir:

In reply to your letter dated April 24,1937 requesting certain information as to the age of water mains now in service in the City of Nashville,I am setting out herein answers to questions as submitted in your letter:

1. When was the first cast iron pipe laid in your water distribution system?
Ans. On July 7,1830,the City Council of Nashville,under the authority of the General Assembly,passed an act to borrow $50,000.00 for the purpose of erecting water works,the first debt incurred by the City. The first cast iron pipe was actually laid during the year 1832.

2. Is the original cast iron line still in service?
Ans. From the available records,it appears that one block of approx. 300 feet length of the original 6-inch cast iron pipe is still in service,and also a short portion of the original 3-inch cast iron pipe.

3. If the original line is not in service,why was it abandoned?
Ans. As of Nov.21,1832 approx. 2206 feet of 6-inch and 534 feet of 3-inch line had been laid. Of this original pipe,approx. 300 feet of 6-inch and 400 feet of 3-inch is still in service. The rest of the pipe has been replaced with larger mains as the City has expanded.

4. What is the age of the oldest cast iron pipe still in service in your system?
Ans. 105 years old, being said 6-inch main in Church St.,formerly Spring St. extending from 2nd Ave.N. westwardly to 3rd Ave.N. and also the 3-inch cast iron pipe in the Public Square extending between 1st Ave.N. and 2nd Ave.N.

Very truly yours

R.L.Lawrence Jr.

Supt. & Chief Engineer
Waterworks Department

We have asked Nashville and 211 other cities whether *original cast iron mains* in their water distribution systems were still in service. Mr. Lawrence's letter (reproduced by permission) is typical of 203 others out of 212—96 percent—whose answers were—*yes*. Only a material with great *bursting* strength, *beam* strength, *crushing* strength, *impact* strength, and *effective corrosion resistance*—indispensable requirements of an underground water main—can render such enduring and economical service.

THE CAST IRON PIPE RESEARCH ASSOCIATION

Thomas F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois

(*Continued from page 10*)

Three years after the enactment of the law, the Attorney General of the U. S. may bring action in equity against the offender in any federal court within whose district the alleged nuisance exists.

The amended bill was in conference when Congress adjourned and will again be subject to consideration when the next session convenes. Members of this Association should inform themselves adequately on the subject. The various state sanitary engineers can be consulted and one's Senator or Congressman interviewed to the end that the legislation, when enacted, be, at the same time, practical and effective in controlling stream pollution adequately.

Ohio, On August first, joined the list of states having Health Department regulations to govern operating personnel for water treatment plants. A Board of Examiners, appointed by the Director of Health, is charged with the duty of examining all candidates for "certificate." Four grades—A, B, C, D—are set up. Grade A requires an engineer's registration certificate and at least six years' experience in plant operation. Grade D, at the other extreme, requires eighth grade school education and at

(*Continued*)

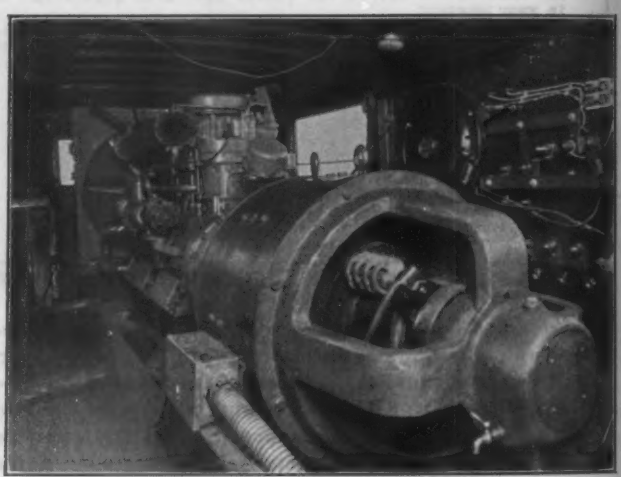
PORTABLE POWER

100 to 300 KW for lighting is available in moderate weight, quiet, powerful generator sets powered with Sterling engines.

STERLING HIGH DUTY

Sterling

INTERNAL COMBUSTION ENGINES



To provide light for night baseball the Kansas City Monarch Baseball Club uses a Sterling Dolphin T-6 cylinder engine driving an Independent Electric Machinery Co. generator.

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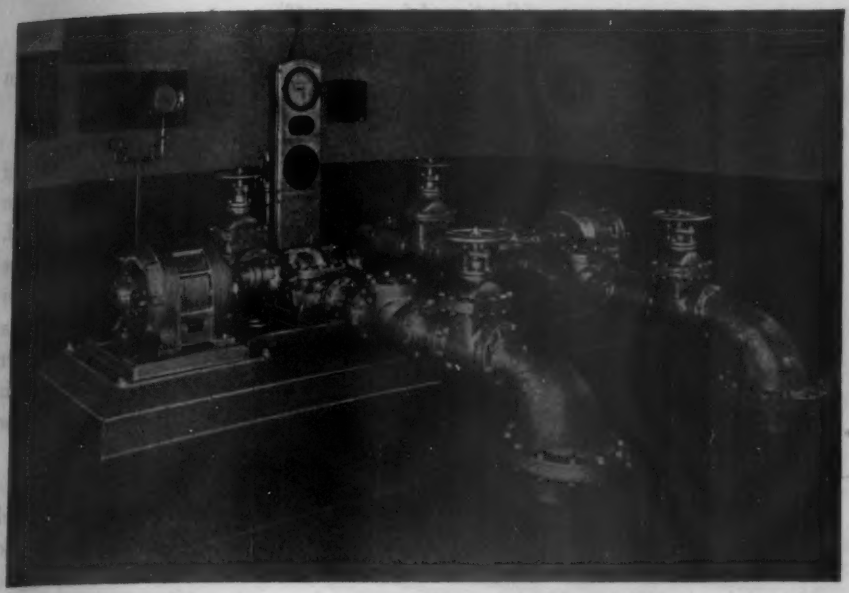

A Booster Station
. . . With Low Operating Cost

TWO ALLIS-CHALMERS Centrifugal Pumping Units, installed in the city of University Park, Texas, are used as boosters to increase the pressure of the water from the City of Dallas mains. The station is entirely automatic, no attendant being required. The elevated tank is located about one mile from the pump station and each unit is started and stopped at the desired water level by use of independent float switches. The low operating cost of this station is secured in large part by using pumping units having high efficiency over the entire operating range. The pumps are Allis-Chalmers 5″ x 4″ Type SHH rated 800-gpm against 160-ft head with 50-hp, 3550-rpm across-the-line Allis-Chalmers motor and 4″ x 3″ SHH rated 500-gpm against 150-ft head, driven by a 30-hp motor.

When you need centrifugal pumps from 30-gpm to 50,000 or more and motors or turbines to drive them, get in touch with Allis-Chalmers.

EQUIPMENT ENGINEERS TO INDUSTRY

ALLIS·CHALMERS

MILWAUKEE WISCONSIN

(*Continued from page 12*)

least one year's plant experience. No fee is to be charged for examination and certification.

A rotary displacement pump intended primarily for fuel, lubricating and heavy crude oils, and called the De Laval-IMO pump, is described in Catalog L-32 issued by the De Laval Steam Turbine Co., Trenton, N. J. This pump, which is designed to run at conventional motor and turbine speeds, has only three moving parts, a central or power rotor and two idler or sealing rotors. The spindle of the power rotor is extended through a stuffing box for connection to the driving motor, but there is no other stuffing box, also no pilot gears, no bearings and no valve. Pumps of this type are built in all capacities and for pressures up to 500 lb. Pumps for higher pressures can be supplied.

The hygiene of housing will be the topic of a symposium presented by the Committee on the Hygiene of Housing of the American Public Health Association. The Committee, with Dr. C.-E. A. Winslow of the Yale School of Public Health as Chairman, has as its object a formulation

(*Continued*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

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75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2″ to 84″

Flanged Pipe *Flexible Joint Pipe*

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Special Castings *Short Body B. & S. Specials*

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

REILLY PIPE ENAMEL & PRIMER

Lasting Protection for Steel Pipe

The life of steel pipe is dependent upon the protective value of its coating. Engineers everywhere recognize the dependability of Reilly coatings and rely upon them for positive protection.

Reilly Enamel and Primer provide a bond between the coating and the steel that is unequaled. Reilly coatings withstand extreme changes in temperature without sagging or checking and give maximum protection against soil acids, alkalies and electrolysis. Reilly Pipe Enamel lining for water lines assures full capacity flow indefinitely . . . Tuberculation, incrustation and bacterial growth cannot take hold on the surface presented by Reilly Enamel.

We shall be glad to have your inquiries and your special protective coating problems will have our prompt and careful attention.

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Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN PLANTS TO SERVE YOU

(*Continued from page 16*)

of minimum standards of planning and construction for low cost housing with a view to making possible healthful homes, at the lowest possible cost. The symposium will be held at 9:30 A.M., Friday, October 8th, in the New Yorker Hotel. All those with a professional interest in housing are invited to attend. A housing exhibition, prepared by the staff of the Committee to demonstrate the historical development of housing and the relation of housing to health, will be on display from October 5th through October 8th in the ballroom of the Hotel Pennsylvania, New York, N. Y.

The Bridgeport Hydraulic Company found itself in the columns of the nation's press when plans for a new impounding reservoir were disclosed. The site of the reservoir, which the company affirms is necessary to the protection of the future needs of the communities it serves, happens also to be the site of several country homes. These homes, many of which are used only in the summer, are owned by artists, writers, doctors and the like who spoke their protests in such words as "octopus" "totalitarian state" and the like, and gave a performance of "Pinafore" to raise funds to fight the water company. Some of the rejoinders indicate that the

(*Continued*)

MODERN FIRE PROTECTION
demands
SAFETOP FIRE HYDRANTS

ARE you planning any water service extensions in your community? If so, be sure to specify Kennedy SAFETOP Fire Hydrants—to provide maximum protection to the neighborhood, with minimum maintenance expense to your department. Kennedy SAFETOP Fire Hydrants meet modern fire service requirements, modern traffic conditions, and modern standards of practical design combined with attractive appearance. *Write for full information*

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

Without a second thought, millions of people drink the water that flows from their faucets . . . that is served at their tables every day in the year.

They drink it without question because they know it is pure . . . because they realize that every possible precaution has been taken to safeguard household water against contamination.

That places a lot of responsibility on the waterworks engineer. And in turn . . . a heavy responsibility on the organizations whose business it is to supply the chemicals for treating water supplies.

General Chemical Company Aluminum Sulphate is manufactured under the most rigid technical control of quality. It is a product on which engineers can rely for strict uniformity of chemical and physical composition. It remains free-flowing . . . dissolves quickly and can be supplied in a wide range of grades and particle sizes.

Write for data on grades and prices of General Chemical Company Aluminum Sulphate.

General Chemical Company

Executive Offices: 40 Rector St., New York City

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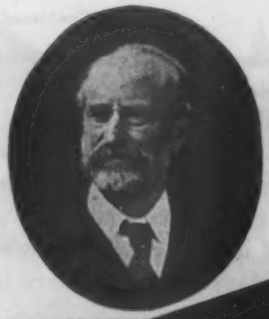
GENERAL CHEMICAL COMPANY

ALUMINUM SULPHATE



Clemens Herschel, *Inventor of the Venturi Tube*

1887 · 1937

The first commercial Venturi Tube

1797-*An Italian Professor of Hydraulics "observes"*

1887-*An American Engineer "dreams"*

1937-*"Venturi" Equipment of world-wide usefulness.*

The "interesting phenomenon" of 1797 becomes the "classic experiment" of 1887 and the "vital necessity" of 1937.

Herschel, in the description of his epoch making tests, remarkably visualized a broad field of usefulness for his invention. Today, however, he would express astonishment over the achievements of control, chemical proportioning, transmission of flow readings for long distances, multiple summation, and master supervision which employ the Venturi Tube as a primary element.

Builders Iron Foundry is proud of its part in this service to mankind.

BUILDERS IRON FOUNDRY
9 CODDING ST., PROVIDENCE, R. I.

(*Continued from page 18*)

company wishes it could stage a performance of "The Tempest" or "Much Ado about Nothing" in rebuttal. Water works engineers who have lived through similar developments know that it is rarely possible to obtain land for storage reservoirs, however greatly the communities need the protection, without disturbances of similar nature. Unfortunately, the water user often little knows and sometimes cares less what's behind the water tap. And if it's not his own household water tap, even if he knows the need, he displays few of the characteristics of the good Samaritan.

Rensselaer Valve Co. offers the new "clearway quick-closing check valve" for use by water works plants having the problem of shut-down slam to combat. An information bulletin will be sent to anyone who requests it.

A special committee of the A.S.T.M. appointed to consider lubricants has transmitted to the A.S.A. a set of revised testing methods with recommendation that they be adopted as standard. They include: Analysis of Grease; Tests for Melting Point of Paraffin Wax; Tests for Gravity of Petroleum and Petroleum Products; Tests for Knock Characteristics of

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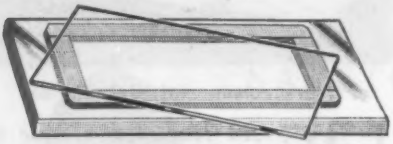
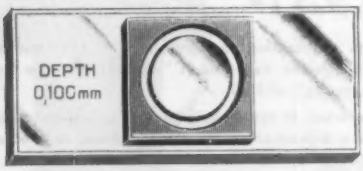
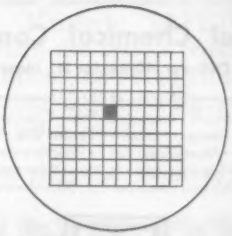


SEDGWICK-RAFTER CELL, Hellige all-glass type with *fused-on* glass frame, more durable than common cells fabricated with soft cement and far superior to the original model having brass frame.

MICRO-ORGANISM COUNTING APPARATUS by HELLIGE



COUNTING CHAMBER, Howard, consisting of heavy glass slide with polished disc, surrounded by 0.1 mm. higher square glass cell, forming chamber 0.1 mm. deep when cover glass is placed on the cell.



MICROMETER (Whipple), for counting micro-organisms in water. The large area is divided into 100 small squares, one of which is divided into 25 squares.

Write for Bulletin No. 612, on Apparatus and Equipment for the Analysis of Water, Sewage, and Industrial Wastes

HELLIGE, INC. 3718 NORTHERN BLVD. LONG ISLAND CITY, N.Y.

13 CONTRACTS TO ALCO TO FURNISH STEEL WATER PIPE FOR THE NATION'S CAPITAL

Approximately 15,000 ft. of 30", 36" and 48" Alco Steel Pipe for the District of Columbia Water Department

Cities Using ALCO STEEL PIPE Include the Following:

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Cincinnati, Ohio
Clarksburg, W. Va.
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Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y.
New Brunswick, N. J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

A *dozen* repeat orders for Alco Electric Welded Steel Pipe have been received from the District of Columbia since the first installation in 1932. This preference, however, is not confined to Washington, D. C., for water works engineers everywhere heartily indorse these

SPECIFIC ALCO FEATURES

- Greater Strength
- Longer Life
- Smoother Waterway
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- Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

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Plants at Dunkirk, N. Y., and Montreal, Canada — Cable Address: Alproducts

DIVISION OF AMERICAN LOCOMOTIVE COMPANY

(*Continued from page 20*)

Motor Fuel; and a Viscosity-Temperature Chart for Liquid Petroleum Products.

From Baltimore comes the news that one of Prof. A. P. Black's graduate students of the University of Florida has joined Activated Alum Corporation's staff as field research engineer. In the traveling laboratory of that company he will work on development in the interest of better coagulation control by actual plant studies in the field.

Under Prof. Black's tutelage, Graham comes to the water works field with a well founded basis on the latest developments in water treatment, having tested many waters in the south in the laboratories of the University of Florida.

An Institute of Local and State Government, which will be supported during the first six years by a gift of $240,000 received from an anonymous source, has been established at the University of Pennsylvania, it is announced by Dr. Thomas S. Gates, president of the University. The new

(*Continued*)

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FILTER SAND
98% Pure Silica

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Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

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Sewerage and Filtration Equipment...

Specify Ludlow gates and valves for trouble-free performance. They are available in all types and sizes—and conform to A.W.W. Association standards. Write for information and quotations.

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Help Build up Your Association by Bringing in a New Member

SEND FOR
APPLICATION BLANKS

AMERICAN WATER WORKS ASSOCIATION
29 W. 39th St.
NEW YORK CITY

(*Continued from page 22*)

institute will enable the University to place increased emphasis upon training for citizenship and public service, and its establishment marks the first major development in a bicentennial program designed to further strengthen the University's work in various fields.

The principal objectives of the Institute of Local and State Government will be:

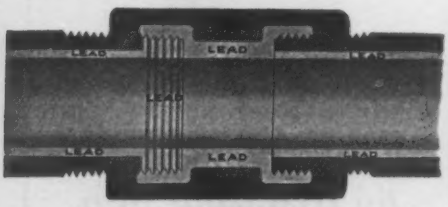
1. To establish as complete a center of practical and printed knowledge about every phase of the problems of municipal, borough, county, township and state government as it is possible to create.

2. To maintain, with the center, an advisory, consulting and informational service for the benefit of local and state government units in the Commonwealth of Pennsylvania and for associations and officials actively concerned with the work of such units.

3. To maintain a center for the training of experts and administrators for cities and other units of local and state government; for the "in-service" training of those now employed in the public service; and, for the education in local and state government affairs of students who expect to enter business or the professions.

(*Continued*)

This shows Pipe just entering Lead Threads of Fitting



This shows Pipe Screwed into Lead Threads and Shoulders of Fittings

For Dependable Service Installations

"Wakefield Galvanized"

Amalgamated Lead Lined Iron Pipe and Fittings

Low Cost—Easily Installed—Permanent

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LEAD LINED IRON PIPE COMPANY
WAKEFIELD, MASS.

All around the plant . .

DIXON'S Industrial PAINT is the best protection in the world for tanks, towers, standpipes, structural steel, cast iron conduits, flumes, boilers, platework, stacks, valves, floor stands, hydrants, meter and curb boxes, pipes and fittings, sluice gates, pumps, steel reservoirs, penstocks, surge tanks, fences, construction machinery and pressure filters.

Dixon's Special system of finishing water tank interiors provides maximum protection to the structure, is non-toxic, imparts neither taste nor color to the water.

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For Unrivalled Accuracy

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This book opens the door to an immense store of knowledge covering studies, problems and experiences of hundreds of water works superintendents, engineers, scientific specialists, etc., during the past fifty-three years.

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29 W. 39th St., New York, N. Y.

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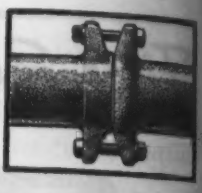

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OFFICES IN PRINCIPAL CITIES COAST TO COAST

(*Continued from page 26*)

4. To maintain a center for conferences, lectures and discussions relating to major questions in the improvement of a city, local and state government in Pennsylvania and other states as a means of educating public opinion, and keeping it focused upon essential objectives.

5. To conduct research into problems which the development of this program may bring to the surface—with particular regard to those problems which consultation and contact with local and state government officials in Pennsylvania may indicate are most important to them.

The institute, offices of which will be in the Wharton School of Finance and Commerce at the University, will have an advisory committee consisting of representatives of the various schools and departments of the University and leaders of various associations of local government officials.

Until that committee is appointed and a director is selected, the work of the institute will be in charge of Dr Stephen B. Sweeney, Associate Professor in the Wharton School, who will serve as acting director and as assistant director on the permanent staff.

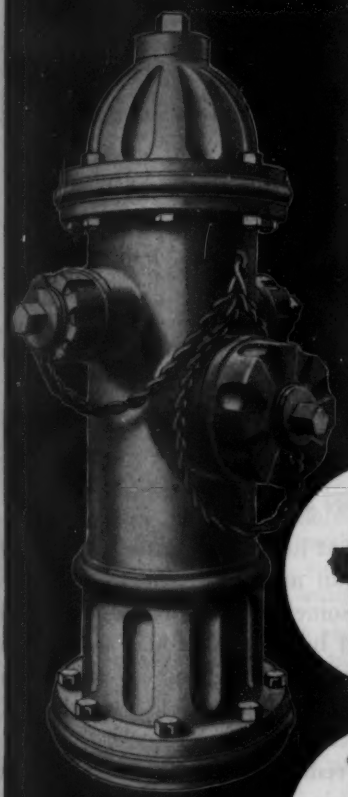
(*Continued*)

ZEO GREENSAND ZEOLITE

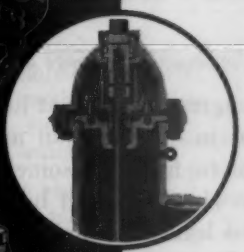
FOR WATER SOFTENING AND IRON REMOVAL

Zeolite Chemical Company, 144 Cedar Street, New York

YOUR FIRE HYDRANT OF TOMORROW — TODAY!



Advanced features like the self-oiling top which keeps parts in working order, the 100% protective safety flange, the non "freezing" bronze seat ring in bronze bushing, the positive water control of the compression type main valve, the leak-proof permanence of the copper gasket are reasons why it is good judgement to specify MUELLER-COLUMBIAN where fire hydrants are needed TODAY. They are certainty of economy and efficiency TOMORROW.



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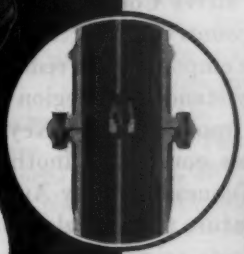
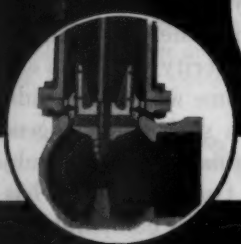
The exclusive wedging mechanism equalizes pressure to four points on the edge of the discs in closing, and completely releases pressure before the discs are raised in opening, eliminating disc strain, seat ring breakage, stem scoring; insuring longer durability.





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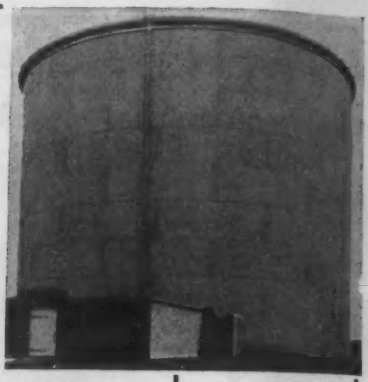

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LIME AND SODA SOFTENERS

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IRON REMOVAL PLANTS

STERILIZERS

(*Continued from page 26*)

While Senators and Congressman are at home for that much needed vacation, persons interested in conservation and development of water resources can take occasion to find out something about the Regional Authority Bills. Known as the Mansfield bill in the House and as the Norris bill in the Senate, this legislation proposes to set up seven regional groups plus the Mississippi River Commission to control the water, land and forest resources of the country.

The President would be empowered to redefine the various boundaries at will. As the matter now stands, one region would include the eastern slope of the Appalachians from Maine to Key West, another the Ohio Valley and the Great Lakes combined, another the Colorado and the rivers of California. The Tennessee Valley Authority would be extended south to the Gulf. One feature that puzzles some who have studied the bills is that plans and projects originating with such federal agencies as the Bureau of Reclamation or the Corps of Engineers would be subject to review by each regional authority affected. One suggestion has been made that such involvement might produce progress comparable to that of a team of horses hitched to a wagon with their bridles tied to the tail gate.

(*Continued*)

A PERMUTIT WATER SOFTENER

wins united support

A municipal water softener makes life better for every member of every family. Clothes washing, dishwashing, scrubbing, cleaning —all are easier with soft water.

Soft water is better for health, too; benefits skin, hair, makes bathing real pleasure. Good for babies, especially. Physicians say hard water causes chafed legs and sour-smelling bodies of infants.

IMPORTANT: Soft water helps cut living costs. Saves soap; laundered clothes and linens fray less, last longer; protects plumbing, saves repair bills; cuts fuel costs; improves cooking, saves coffee.

Permutit municipal water softening projects win united support, help everybody and pay their way. Other Permutit equipment removes bad taste, odor, iron, dirt or corrosive qualities from water supply. Write for information, references, estimates. Address your inquiry to The Permutit Company, Dept. G2, 330 West 42nd Street, New York, N. Y.

Permutit

WORLD'S LARGEST SPECIALIST IN

Water Conditioning

(*Continued from page 33*)

Both measures would make it immediately unlawful to continue to discharge industrial waste or sewage into any stream if pollution or unsightliness results. While the House measure is an out-and-out prohibition, the Senate measure prohibits only if plans have not been approved by the appropriate geographical Authority.

In addition to prohibiting the construction of a "sewer or . . . other or different . . . polluter affecting navigation, the use of navigable waters, flood control and prevention, the public lands or property of the United States" the Senate measure would also prohibit the construction of any dam, wharf, bridge, or other construction across, along, or in any navigable stream or any tributary thereof, unless there has been approval by the Regional Authority.

With respect to the construction and operation of projects that may receive the approval of Congress there is this difference between the two bills: the Authorities created by the Senate bill to do the planning for the respective regions are also authorized to construct and operate the projects.

(*Continued*)

DIFCO

Bacto-Lactose Broth
for the Presumptive Test for Coli

Bacto-Lactose Broth is the medium of choice for the presumptive detection of coliform organisms in water. When the dehydrated medium is prepared for use in the laboratory it conforms in every respect to the formula recommended in "Standard Methods of Water Analysis." Results obtained by the direct inoculation of water into tubes of this medium are reliable and accurate.

Liquid Confirmatory Media
for Confirmation of Positive Presumptive Tests

The new confirmatory media proposed in "Standard Methods" are available in dehydrated form. It is recommended that selection of any of these media be based on correlation of positive confirmations.

Bacto-Brilliant Green Bile 2%
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Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

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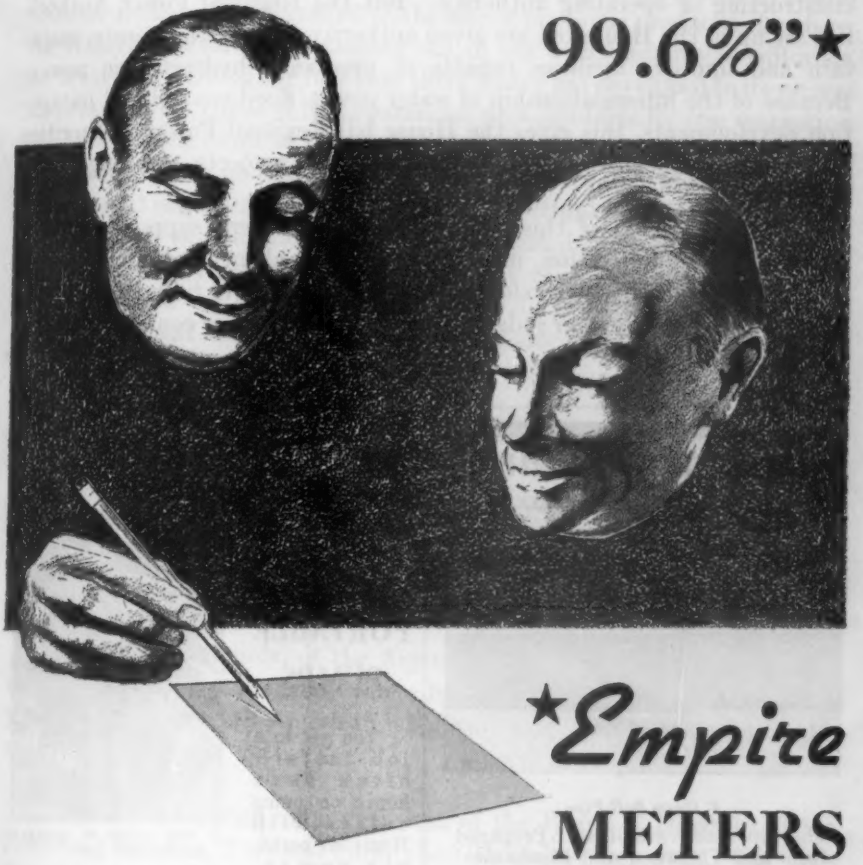
"Every meter tested on South Street had an average of 99.6%"★



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Trade Mark MABBS Reg. U. S. Pat. Off.

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892,* **431 S. Dearborn St., Chicago, Ill.**

(Continued from page 34)

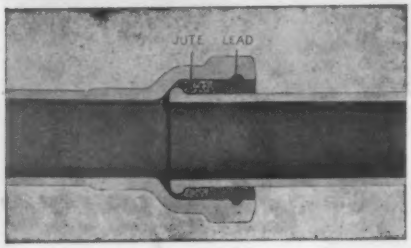
The Regional Planning Agencies of the House bill, however, do not have constructing or operating authority. But the Regional Power Authorities set up in the House bill are given authority to control, operate, maintain and improve facilities capable of producing hydroelectric power. Because of the interrelationship of water power, flood control and navigation developments, this gives the House bill Regional Power Authorities wide powers of construction and operation of projects affecting water resources.

Since legislation of this character has the ardent support of those close to the administration, it is important that all persons who have an interest in water supply development inform themselves fully and support or oppose the bills as their judgment indicates the proper course to pursue.

(Continued)

2″ CAST IRON PIPE

Furnished full 2″ I. D.



2″ Open Bell Pipe

This pipe also available with Prepared Joint and Threaded and Mechanical Joint construction, for convenience and economy in installing, and to allow for expansion and contraction in the line.

Complete Line of 2″ Fittings

AMERICAN CAST IRON PIPE CO.

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Dallas Los Angeles San Francisco Pittsburgh
Cleveland

FOR *Speed...*

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HOMELITE PORTABLE PUMPS

2″ unit weight 86 pounds—pumps 8,000 gph
3″ unit weighs 93 pounds—pumps 1500 gph

You get to a job faster—often save hours on pump delays with Homelite portable pumps. One man carries a Homelite easily, sets it up quickly wherever needed. Starting is a matter of seconds in any weather. A Homelite primes itself, handles thick muddy water, keeps seepage down to strainer level all the time. Suction lift is 28′. Write for bulletin.

HOMELITE CORPORATION

1609 RIVERDALE AVE. PORT CHESTER, N. Y.

(*Continued from page 36*)

Salesmen of nationally distributed water works materials have faced in recent months two tendencies among purchasers, both destructive of the best interests of the community needing the material.

In one case, it has been found that the appointment of a local agent to represent the nationally distributed article was necessary if full consideration was given by the purchase authorities. In the other case, preference was given to materials produced within the state and an almost insurmountable barrier existed to the sale of materials produced elsewhere. As Willard Chevalier has pointed out in one of his admirable editorials, we must not overlook the fact that this country has developed to its present state largely by virtue of its unparalleled area available for free marketing.

The walled cities of feudal Europe found themselves left in the distance when the industrial development got under way. If history teaches anything, it condemns isolation. It is silly to think of any city's attempting economic self-sufficiency. It is an inverted form of secession from the republic to set up state tariffs. The buyers of water works equipment will serve their customers best if they open doors wide to the sellers of all good equipment and let the honest economic differentials govern the purchase choice.

Fr. Sentenac, "Ing. en Chef des Ponts et Ch., Inspect. gen. du Service Tech. des Eaux et de l'Assainiss, de la Ville de Paris," together with two members of the Municipal Council of Paris, arrived in New York on September 8th for a tour of inspection of American water purification plants. Their preliminary plans include visits to Montreal, Toronto, Buffalo, Detroit, Chicago, St. Louis, San Francisco, Los Angeles and New Orleans.

Dr. Raul Ferromola, of the Argentine National Water Board, was a recent visitor at headquarters where he was assisted in the planning of a month's tour of North American laboratories devoted to control of water supply.

Alexander G. McKenna, chairman of the Board of Directors of the Pomona Pump Co., Pomona, Calif., died Thursday, July 29th. Mr. McKenna had been engaged in manufacturing for more than a half century. Together with his son, G. A. McKenna, he purchased the Pomona Pump Co. (Assoc. M., A.W.W.A.) in 1923. He directed the reorganization of the pump company's engineering and manufacturing departments, all of which resulted in improvement in design and efficiency of the company's products.

APPLICATION FOR MEMBERSHIP
IN THE
AMERICAN WATER WORKS ASSOCIATION
29 W. 39th Street, New York, N. Y.

Date:.....

.....hereby make application for.....Membership
(I or We) (Active, Corporate or Associate)
in the American Water Works Association, and enclose herewith the sum of

$.....the required initiation fee* and one year's dues in advance.

Name.....

Title or Business.....

Address.....

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Business or Professional Experience.....

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ARTICLE I OF BY-LAWS

Section 3. An Active Member shall be a superintendent, a manager, an official or employee of a municipal or private water works; a civil, mechanical, hydraulic, or sanitary engineer, a chemist, a bacteriologist, or any qualified person engaged or interested in the advancement of knowledge relating to water supplies. (Initiation Fee, $5.00; Annual Dues, $10.00.)

Section 4. A Corporate Member shall be a Water Board, Water Commission, Water Department, Water Company or Corporation, National, State or District Board of Health, or other body, corporation or organization engaged or interested in water supply work, and shall be entitled to one representative whose name shall appear on the roll of members, and who shall have all the rights and privileges of an Active Member. This representative may be changed at the convenience and pleasure of the Corporate Member on written notice to the Secretary. (Initiation Fee, $10.00; Annual Dues, $15.00.)

Section 5. An Associate Member shall be either a person, firm or corporation engaged in manufacturing or furnishing supplies for the operation, construction, or maintenance of water works. (Initiation Fee, $10.00; Annual Dues, $25.00.)

Membership in the Association carries also membership in its Local Sections and National Divisions, and includes the Journal, a monthly publication devoted to water works interest. The proceedings of the annual conventions and of the meetings of the Local Sections are published in the Journal, which also contains contributed articles on subjects pertaining to public water supplies.

* *Initiation Fee Waived During 1937*

NEWS OF THE FIELD

The assets of an association such as the A. W. W. A. are much greater than the total dollars in the bank account. Dollars are useful and necessary. They keep the mechanism going. But the currency total, whatever it is, must be supplemented by what, in our case, are best described as "Technical Assets."

One way of describing such valuable property is to speak of the spirit and loyalty of the members of the organization. This is a recognition of the fact that an association is not worth while if the bulk of its members do not have an active interest in it—not alone in its conventions or its publications, but also in the work which the members banded together are doing on their own behalf. The willingness of members to devote their time to committee work and the results of this work are the things which build up the technical assets of the organization.

Every one in the Association became a member because he felt that he would be able to do his work better if he were a member. He also by that affiliation recorded his willingness to take part in the useful work of the Association.

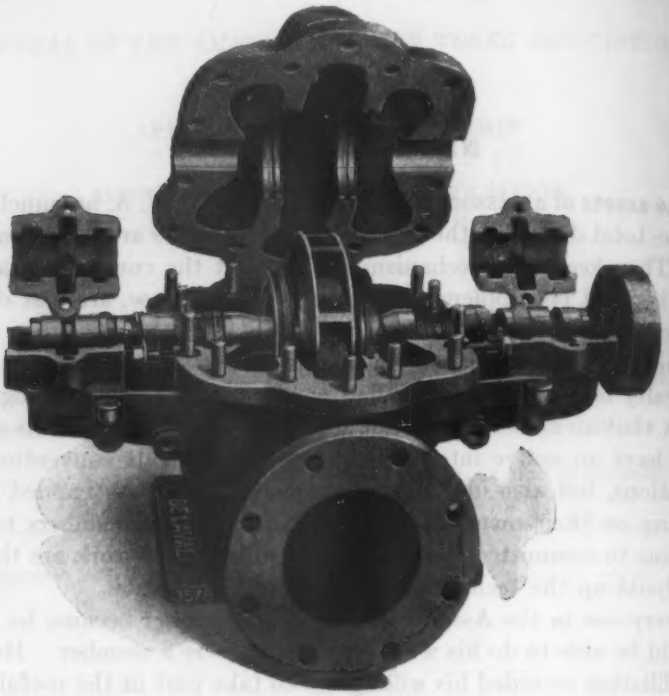
Water works men want guidance. They want to know the best ways of doing things. They want standards for their operations and broadly applicable specifications for the materials they buy. But those things do not spring full grown from the mind of a single individual. If they are useful, they have blended in them the composite experience of the field—the lessons from failures and the benefits of success. They are the more useful when many men have contributed to their preparation.

When they are done and are actively in use, they build up the credit of the organization. They are its technical assets. Perhaps some of you may not have thought of the situation just in these terms, but the fact exists that, if an organization such as this does not build up the professional and material standards in its field of interest, it gets no place.

Members and dollar dues are needed, but they must both be combined with the willingness to serve association interest and the fruits of that work if the organization is actually prosperous.

It is the recognition of these facts that has led your officers to do much work in recent months to rehabilitate the activities of its members and organize them along the lines of need for service to the field. And the results of that revival of interest are decidedly gratifying. The American Water Works Association is moving forward.

(Continued)



LOOK INSIDE

Before you purchase a centrifugal pump it will pay you to look into performance characteristics, materials and methods of production.

DE LAVAL CENTRIFUGAL PUMPS

are designed for continued high efficiency. At points where wear may occur the main members of the pump are protected by renewable wearing parts, the most important being the labyrinth rings which protect both the casing and IMPELLER and reduce leakage at the joints dividing the suction from the discharge passages. Due to limit gage manufacture, all parts are interchangeable and the excellent initial efficiency can be easily maintained.

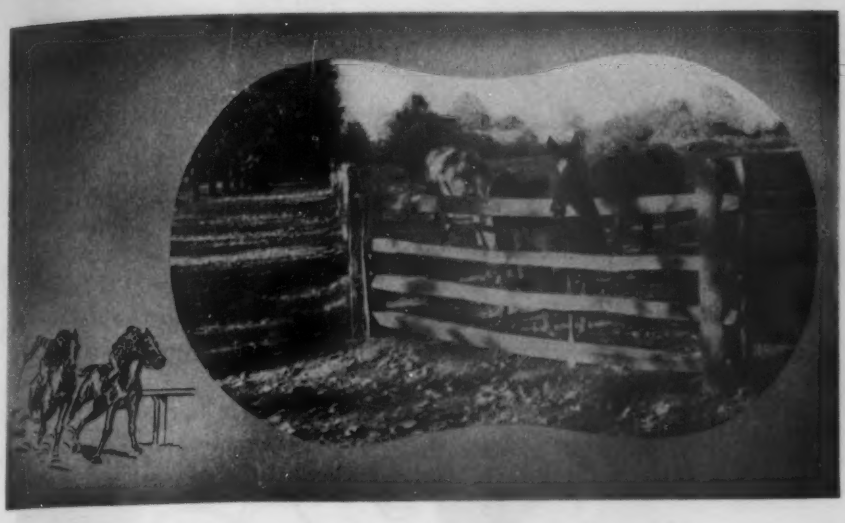
Inasmuch as power costs ultimately exceed first cost many times over, the ease with which the efficiency of a De Laval pump may be maintained by replacement of minor parts subject to wear is of great value to the user.

DE LAVAL STEAM TURBINE COMPANY

Trenton, New Jersey

Manufacturers of Steam Turbines, Centrifugal Pumps, Propeller Pumps, Motor Mounted Pumps, Rotary Displacement Pumps, Centrifugal Blowers and compressors Worm Gears, Helical Speed Reducing Gears, Hydraulic Turbines, Flexible Couplings. Sole Licensee of the Bauer-Wach Exhaust Turbine System.

3145



PREPARATION • • •

THE public seldom realizes the preparation required in producing water suitable for household needs. Careful as the personnel may be in preparing water free from bacteria and suspended matter, nevertheless, if tastes and odors are present in the tap, Mr. John Public in the smaller communities will usually resort to water from unauthorized sources, in the belief that the sparkling glass of well, or spring water, represents the "tops". Case history is replete with serious epidemics resulting from the use of unauthorized sources of water.

In the larger communities, when tastes and odors break through, Mr. and Mrs. John Public and their neighbors rise in protest and flood the Water Department with complaints, abuses, etc. The local press, with their headlines, play this situation up as important news and frequently it either results in the dismissal or the non-appointment of personnel who have well served their Municipality.

Why not follow the lead of many Municipalities in feeding ACTIVATED CARBON daily so that when serious tastes and odors are present in the raw water supply, the plant has already been seeded with ACTIVATED CARBON and and all that is necessary is to step up the dose in order to furnish a palatable water free from complaint.

Our Service Men are prepared to run Threshold Tests in your Plant, to show where the application of ACTIVATED CARBON will give you the most economical use.

NUCHAR

We have released to over 1,000 newspapers a résumé of the treatment water is given to make it fit for household use with the idea of building up Good-Will for the water personnel. Mimeographed copies are available to water men in the event they wish to use it with their local newspaper.

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 Park Avenue
New York, N. Y.

417 Schofield Building
Cleveland, Ohio

205 West Wacker Drive
Chicago, Illinois

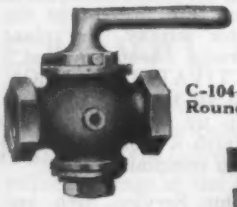
(*Continued from page 1*)

Reeves J. Newsom, who has been in charge of the engineering and operation of the subsidiaries of Community Water Service Company since 1926, has announced his retirement as President of that company and his entrance into private practice as Consulting Engineer with offices at 500 Fifth Avenue, New York City. Prior to taking charge of that group of private companies, Mr. Newsom spent twelve years in the municipal field, eight years as Commissioner of Water and Chief Engineer at Lynn, Mass.

Mr. Newsom will practice in collaboration with James C. Harding, of New York City and Mt. Kisco, who has been active as a consulting engineer in water works and sewerage for the last ten years.

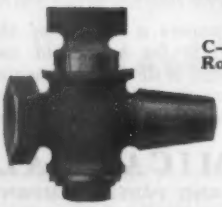
(*Continued*)

KITSON



C-104—Solid Lever Roundway S. & W.

C-101—Solid Tee Roundway Stop



C-105 Solid Tee Roundway Stop—Lead and Iron

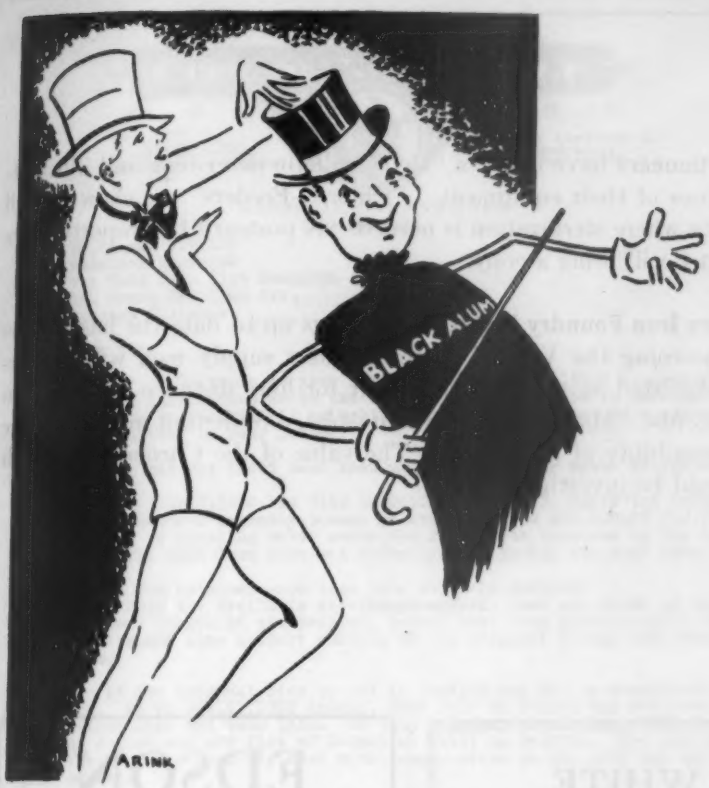
ROUNDWAY STOPS

C-111
Solid Tee Roundway Stop & Waste Lead Pipe

Write for details and prices. No obligation.

KITSON COMPANY
2409-15 WESTMORELAND STREET
PHILADELPHIA, PA.

Manufacturers of: Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.



MR. B. ALUM *goes to town!*

NOW USED IN 14 STATES

Produces better water

WE ALSO MANUFACTURE

- **STANDARD ACTIVATED ALUM**
- **REGULAR ALUM**

Do not sign your next year's Alum contract until you have tested our Alums and received our price quotations.

Activated Alum Corp.

Office:
80 Broad Street
New York, N. Y.

Works:
Curtis Bay
Baltimore, Maryland

(*Continued from page 4*)

Proportioneers have issued a "Red" bulletin describing and illustrating many uses of their equipment. "Chlor-O-Feeders" are shown at all kinds of jobs where sterilization is needed. A postcard to Proportioneers at Providence will bring a copy.

Builders Iron Foundry Bulletin 293 brings up to date the basic information concerning the Venturi meter. Water supply men will be particularly interested in the Chronoflo unit for long distance transmission of meter records. Many plants have an isolated or distant meter and the need of accessibility of its records. The value of the Chronoflo for such service should be investigated.

(*Continued*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

CITY OF NASHVILLE

OFFICE
SUPERINTENDENT
AND CHIEF ENGINEER
WATERWORKS DEPARTMENT
CITY HALL

ROBERT L. LAWRENCE, Jr.
SUPERINTENDENT
AND CHIEF ENGINEER

NASHVILLE, TENNESSEE
June 25-1937

Mr.Thomas F.Wolfe
Research Engineer
The Cast Iron Pipe Research Association
122 South Michigan Ave.
Chicago Illinois

Dear Sir:

In reply to your letter dated April 24,1937 requesting certain information as to the age of water mains now in service in the City of Nashville,I am setting out herein answers to questions as submitted in your letter:

1. When was the first cast iron pipe laid in your water distribution system?
Ans. On July 7,1830,the City Council of Nashville,under the authority of the General Assembly,passed an act to borrow $50,000.00 for the purpose of erecting water works,the first debt incurred by the City. The first cast iron pipe was actually laid during the year 1832.

2. Is the original cast iron line still in service?
Ans. From the available records,it appears that one block of approx. 300 foot length of the original 6-inch cast iron pipe is still in service,and also a short portion of the original 3-inch cast iron pipe.

3. If the original line is not in service,why was it abandoned?
Ans. As of Nov.21,1832 approx. 2206 feet of 6-inch and 534 feet of 3-inch line had been laid. Of this original pipe,approx. 300 feet of 6-inch and 400 feet of 3-inch is still in service. The rest of the pipe has been replaced with larger mains as the City has expanded.

4. What is the age of the oldest cast iron pipe still in service in your system?
Ans. 105 years old, being said 6-inch main in Church St.,formerly Spring St. extending from 2nd Ave.N. westwardly to 3rd Ave.N. and also the 3-inch cast iron pipe in the Public Square extending between 1st Ave.N. and 2nd Ave.N.

Very truly yours

R.L.Lawrence Jr

Supt. & Chief Engineer
Waterworks Department

We have asked Nashville and 211 other cities whether *original cast iron mains* in their water distribution systems were still in service. Mr. Lawrence's letter (reproduced by permission) is typical of 203 others out of 212—96 percent—whose answers were—*yes*. Only a material with great *bursting* strength, *beam* strength, *crushing* strength, *impact* strength, and *effective corrosion resistance*—indispensable requirements of an underground water main—can render such enduring and economical service.

THE CAST IRON PIPE RESEARCH ASSOCIATION
Thomas F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois

(Continued from page 6)

Recent developments in higher steam pressures and temperatures, in boiler and combustion equipment, in steam turbines and in the application of exhaust and bled steam, and how these have all combined to make possible great economies in the generation of power and heat for buildings and industrial plants, is the theme of a 12-page, 11 x 16 in. brochure entitled "Modern Turbines to Reduce Costs," issued by the De Laval Steam Turbine Co., Trenton, N. J. Cheaper fuels can now be burned with less labor and with higher efficiency and much more power can be generated from a given weight of steam than formerly. Less building space is required, or increased demands for power can be met without increased costs for buildings and foundations. In many cases existing equipment, if in good condition, can be retained by superposing a high pressure boiler and turbine, the latter exhausting into the present steam mains. Engineers and owners of steam plants may study with interest and profit the great variety of steam turbine applications which are set forth in the text and illustrations of this publication, which will be sent free upon request.

(Continued)

The fire hydrant for maximum economy-safety-dependability

IF A Kennedy SAFETOP hydrant is struck by a smashing impact, there is no flooding, the water supply need not be shut off while awaiting or making repairs, and the hydrant can be returned to service by one man, within half an hour, without excavating, and at a total cost of less than $10.00 for new parts and labor.

In addition to these important benefits, the Kennedy SAFETOP Fire Hydrant responds promptly and effectively to service demands. Its large-diameter standpipe and smooth water passages keep pressure loss to a minimum, and its simple, sturdy, straight-line mechanism functions easily and positively.

Write for Complete Information

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY
SAFETOP
REG. U.S. PAT. OFF.
FIRE HYDRANT

● It is second nature in a whale of a lot of plants to reach for a Crane No. 52 Catalog and say, "You'll find it in here," whenever a question concerning valves, fittings or piping arises. It is a mighty sensible habit, too, for your Crane No. 52 Catalog contains more items, more dimensions and more piping engineering data than does any other such publication in the world.

Not only does it have such information but it makes ordering swift and easy—and you know that the valves, fittings and piping which you order will uniformly be of the highest quality. Whatever your next job involving piping may be, turn to your Crane Co. 52 Catalog first. You'll find that for common and for most "new" valve problems, Crane has an answer in items proved and ready for use. They're all among the 38,000 listed in this catalog. Order from it to CranEquip for satisfaction.

CRANE

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVE., CHICAGO, ILLINOIS

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, PLUMBING AND HEATING MATERIAL

plied in the next few days.

EASY SOLUTION FOR VALVE INVENTORY

NEW YORK CITY, Oct. 6—The easiest way to solve the inventory problem for valves and valve parts needed to maintain a water or sewage system is to standardize on Crane valves. Parts are instantly interchangeable because of extremely accurate gauging and rigid inspection. Duplicate sizes are avoided, and responsibility for service is focused in one spot.

Standardizing on CranEquipment is a sure method of cutting inventory costs as well as increasing the dependability of your system. From Crane you can purchase practically every item you may need, backed by Crane's reputation for high quality and fine performance.

More than that, the distribution of Crane products through Crane branches and distributors is so widespread that you can keep your inventories low because you can rely on swift service from the Crane organization. Steady progress toward CranEquipping is being made by many a city water and sewage system through the simple method of using Crane products for all replacements and additions. CranEquip for piping satisfaction.

(*Continued from page 10*)

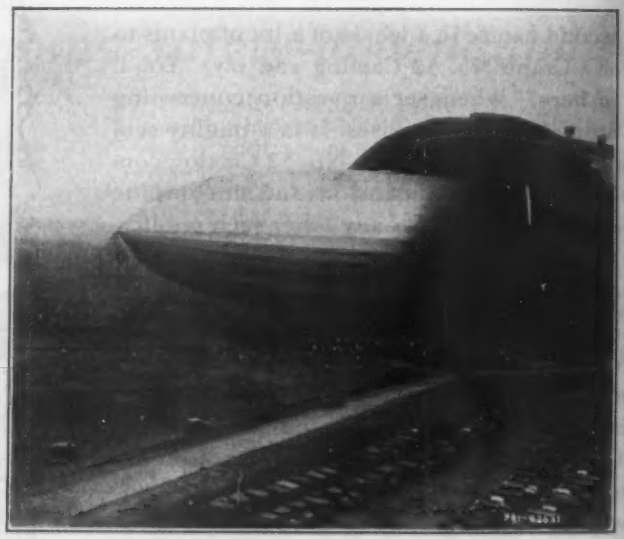
Our 1938 convention city, New Orleans, treated itself to a deluge on October 2nd. In 24 hours, 12½ inches of rain fell; people were marooned in their homes and offices; sandbags were placed at store doors to keep the water out; transportation was demoralized, and even the police switchboard was out of commission. Nothing like the storm has occurred for ten years.

One of the things to see when A. W. W. A. members go to New Orleans for the convention is the equipment provided to pump the storm water away. It takes a deluge such as the recent one to renew the satisfaction of New Orleans citizens with the work of the Sewerage and Water Board. The people know how much better off they are than they would be without the service ordinarily adequate.

(*Continued*)

OVER 1000 STERLING INSTALLATIONS AND EVERY ONE IS SUCCESSFUL

The Akron and Lakehurst Navy Mooring Masts, triumphs of a new order of engineering, are equipped with Sterling straight 8 cylinder engines driving electric generators.



The Portable Mooring Mast of the Goodyear-Zeppelin Corp., Akron, Ohio, for mooring the U. S. S. Akron and other rigid airships is powered by a Sterling Dolphin T-8 cylinder 240 H. P. engine driving a 125 KW generator 1200 R.P.M.

STERLING HIGH DUTY

Sterling

INTERNAL COMBUSTION ENGINES

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

STERLING ENGINE COMPANY
Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

13 CONTRACTS TO ALCO TO FURNISH STEEL WATER PIPE FOR THE NATION'S CAPITAL

Approximately 15,000 ft. of 30", 36" and 48" Alco Steel Pipe for the District of Columbia Water Department

Cities Using ALCO STEEL PIPE Include the Following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W. Va.
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y.
New Brunswick, N. J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

A *dozen* repeat orders for Alco Electric Welded Steel Pipe have been received from the District of Columbia since the first installation in 1932. This preference, however, is not confined to Washington, D. C., for water works engineers everywhere heartily indorse these

SPECIFIC ALCO FEATURES

- Greater Strength
- Longer Life
- Smoother Waterway
- Longer Lengths
- Fewer Field Joints
- Low Initial Cost
- Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS, INCORPORATED

30 Church Street — New York, N. Y.

CHICAGO — WASHINGTON — HOUSTON — TULSA

Plants at Dunkirk, N. Y., and Montreal, Canada — Cable Address: Alproducts

DIVISION OF AMERICAN [illegible] COMPANY

(*Continued from page 12*)

The 1937 U. S. Housing Act makes available $500,000,000 for low cost housing in the next three years. It is estimated that over 100,000 homes will be built. Not more than 10 per cent of the amount can be spent in any one state. In cities below 500,000 the total cost per family unit may not exceed $4,000 or the per room cost exceed $1,000. In large cities, the all-inclusive cost may be no more than $5,000 or the per room cost more than $1,250. Rents, including light, heat and cooking fuel, can be no more than $\frac{1}{5}$ the income of families selected as tenants or more than $\frac{1}{6}$ the income of families with 3 or more children.

(*Continued*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2″ to 84″

Flanged Pipe *Flexible Joint Pipe*

Bell and Spigot Pipe

Special Castings *Short Body B. & S. Specials*

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

IF TYPHOID CAME OUT!

A whole city can be wiped out almost overnight if typhoid should come out of the water tap. But it doesn't, thanks to the bacteriologist, the sanitary engineer, the water chemist—and Liquid Chlorine!

Every day and night—though the river overflows its banks, though the wind whips into hurricanes and the earth shakes and cracks, water men depend on their Chlorine supply to ward off the diseases men used to call plagues.

Solvay's "BIG 3" Service is a service on which water-works engineers can *always* depend for Liquid Chlorine . . . depend upon for quick, efficient deliveries and for technical cooperation and assistance when it is required!

Solvay Liquid Chlorine is now shipped from Syracuse, New York; Hopewell, Virginia; and upon announcement during the early part of 1938, will be shipped from the new Solvay Liquid Chlorine plant at Baton Rouge, Louisiana. Inquiries on Solvay Liquid Chlorine are cordially solicited from State and Municipal water-works departments, and from manufacturers and other users.

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 Rector Street **New York**

Branch Sales Offices:

Boston Charlotte Chicago Cincinnati
Cleveland Detroit Indianapolis
Kansas City New Orleans New York Philadelphia
Pittsburgh St. Louis Syracuse

(*Continued from page 16*)

The National Farm Chemurgic Council points out the fact that the projects it plans will afford industrial use for the products of fifty million acres of American land and will make jobs for five million men.

Ten years ago, they say, the soy bean was an insignificant crop in this country. The 1937 crop will total over fifty million bushels and more than 300 food and industrial uses for the beans have been developed.

The Southeastern States are enjoying an industrial construction boom as a result of the research and persistence of Dr. C. H. Herty. As a result of his studies in utilization of southern pine for paper making, a hundred million dollars are being invested in pulp, kraft and newsprint paper mills.

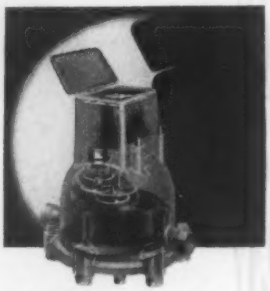
It is shown that as agricultural income rises and falls, so likewise varies the national factory payroll.

So the Chemurgic Council proposes to balance the agricultural income by the promotion of products from the soil that do not have to be eaten but are raw materials for industry.

(*Continued*)

Accurate in measurement ...low in over-all costs

National Meters convert waste into revenue!



Empire
Nash
Crown
Empire-Compound
Gem
Premier

That accuracy is inherent in all National Water Meters is recognized and attested by thousands of users now securing maximum revenue through the accurate measurement of all water services, large and small.

Yet the total cost of a National Meter is less than that of an ordinary meter, for National Meters require only a minimum of maintenance while rendering maximum service.

Why not investigate the complete line of National Meters . . . for accuracy . . . for low over-all cost? Complete information will be sent without obligation or cost.

NATIONAL *Meter* COMPANY

4203 FIRST AVENUE
BROOKLYN, N. Y.

BOSTON · CHICAGO · DALLAS
LOS ANGELES · SAN FRANCISCO

ELEVATED TANKS by P·DM

THAT'S LIKE "STERLING" on SILVER

Yes, truly sterling meaning "of high merit" and embodying the *know-how* of master engineering . . . perfect craftsmanship . . . accumulated through 41 years of tank-building. Every unit is 100% guaranteed for flawless durability and care-free performance. These factors combined with P·DM designing service and field service insure perfect satisfaction and furnish your best reason for coming *first* to P·DM when tanks are needed.

PITTSBURGH · DES MOINES STEEL CO.

PITTSBURGH, PA. 3424 NEVILLE ISLAND—DES MOINES, IA. 925 TUTTLE ST.

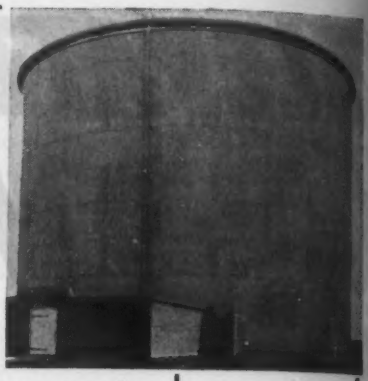
NEW YORK, ROOM 921-99, 270 BROADWAY . . CHICAGO, 1228 FIRST NATIONAL BANK BLDG.

DALLAS, 1229 PRAETORIAN BUILDING SAN FRANCISCO, 631 RIALTO BUILDING

GENERAL STEEL PLATE CONSTRUCTION

GRAVER TANKS

WATER CONDITIONING EQUIPMENT



ENDURANCE

Into every Graver Tank and Steel Structure is built unsurpassed endurance—the result of three-quarters of a century experience in skilled designing, fabricating and erecting leak-proof vessels for every conceivable purpose.

Send for Literature Today

GRAVER TANK & MFG. CO., INC.

75 Years of Dependable Service

New York, N.Y. East Chicago, Ind. Chicago, Ill. Catasauqua, Pa.

SETTLERS

FILTERS FOR MINERAL, TASTE, COLOR, ODOR REMOVAL

LIME AND SODA SOFTENERS

ZEOLITE SOFTENERS

IRON REMOVAL PLANTS

STERILIZERS

(*Continued from page 18*)

A new bulletin describing Bristol's Recording Milli-voltmeter for Electrolysis Surveys has been recently completed by The Bristol Company, Waterbury, Connecticut.

The publication contains illustrations and complete descriptive information regarding these instruments—the galvanometer movements, their sensitivity to conform with the application, and their ruggedness for withstanding rough use and transportation without special handling precautions. Also, a list of available scales and ranges is included.

Bulletin 762 has just been issued by the Chicago Pneumatic Tool Company to illustrate their Diesel engine-driven compressors. If the promosed resumption of building activity gets under way, water works men will be needing portable compressors for their pipe and valve crews.

(*Continued*)

HERSEY COMPOUND METER

(*Continued from page 20*)

Normally most of the country's building is done by private enterprise, but in recent years, due to the large amounts expended for public works, this situation has been reversed. In 1928, 77.5 of the construction was "private" and 22.5 "public." In 1936, only 44.5 per cent was "private" and 55.5 "public." The change is reflected in the following table:

Construction by types as a percentage of total

	1928	1933	1936
Private residential	39.2	13.4	18.4
Private non-residential	20.1	10.0	9.7
Total private utilities	18.2	15.6	16.4
State and local	20.7	49.5	48.0
Including grants			
Federal	1.8	11.5	7.5
Excluding grants			
Total	100.0	100.0	100.0

Residential construction, as shown by the previous table, was formerly the most important item in the nation's construction account. In 1928, it was 39.2 per cent of the total. In 1936, it was only 18.4 per cent of the total. It is evident that, to approach a normal recovery in construction, residential building must be considerably increased. Thus, the housing problem has a direct bearing upon recovery, quite aside from its importance in relation to the promotion of living standards.

The condition of the housing plant is indicated in some measure by the following:

Condition of dwelling units in 64 cities

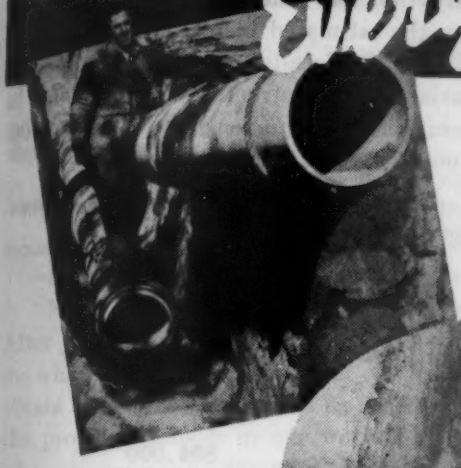
	Number	Per cent
Good	946,553	38.97
Need minor repairs	1,081,385	44.52
Need major repairs	357,005	14.70
Unfit for use	41,891	1.72
Not reported	2,073	.09
Total	2,428,907	100.00

—*Source, Real Property Inventory, U. S. Department of Commerce.*

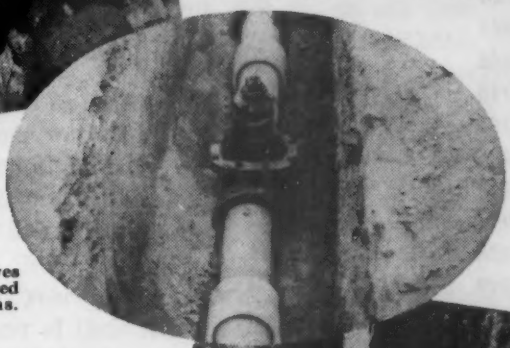
(*Continued*)

Every Week... Everywhere...

More Transite Pipe Goes Down



RHODE ISLAND. J-M Transite Pipe is easy to handle. Mechanical equipment is not needed, except on the largest sizes.



IDAHO (oval). Valves are readily inserted in Transite mains.

HERE, for the first time, is a pipe that combines every feature waterworks engineers demand. It is strong, light and durable, remarkably resistant to corrosive soils and waters, and has an unusually smooth interior surface that offers minimum resistance to the flow of water. The resulting low pumping costs are permanent, for Transite Pipe's high delivery capacity can *never* be reduced by tuberculation.

It will pay you to get complete information on this modern water pipe. Write for the Transite Pressure Pipe brochure. Johns-Manville, 22 East 40th Street, New York City.

ILLINOIS. Simplex Couplings are quickly and easily applied, even by unskilled labor. The result—notable savings in installation costs.

JM JOHNS-MANVILLE

TRANSITE PRESSURE PIPE AN ASBESTOS PRODUCT

(*Continued from page 32*)

Since 1930 residential construction has fallen far short of meeting normal requirements measured by the estimated increase in the number of families or housekeeping units. In the decade 1920–1929 the average annual number of family residential units constructed was 677,000. In the seven years, 1930–36, the average annual number dropped to 165,000. In 1934 only 59,000 were constructed.

Estimated number of family units upon which construction was started annually in urban and rural non-farm areas in the United States

Year	Total non-farm	
1920	310,000	
1921	432,000	
1922	676,000	
1923	814,000	
1924	827,000	
1925	894,000	
1926	841,000	
1927	757,000	
1928	713,000	
1929	510,000	
Average 1920–1929		677,000
1930	303,000	
1931	219,000	
1932	94,000	
1933	64,000	
1934	59,000	
1935	128,000	
1936	275,000	
Average 1930–1936		165,000

—*Source, Lowell J. Chawner, Senior Economist, U. S. Department of Commerce.*

(*Continued*)

(*Continued from page 36*)

Let's look ahead to 1938. This is the time of year to plan your budget and to scan the lists of available material to see just what equipment you are going to need. Ask yourself these questions:

1. Is '38 likely to be a year of new construction or increasing productive capacity?
2. If so, will the rate of expansion probably increase or decrease over '37?
3. If not, is it merely a temporary pause in growth or a permanent slowing down?
4. Is '38 likely to bring a heavy volume of modernization?
5. If not, is it because modernization is not needed, because conditions do not justify the expenditure, or because money is not forthcoming?
6. Is '38 likely to require heavy purchases for maintenance?

Now, Mr. Manager or Superintendent, will you do one more thing? After you have studied these questions, will you write me a letter telling me what the prospect is in your city and area? This is a serious effort to obtain a cross section of the water works viewpoint so that we may plan the proper emphasis in our work for 1938. Just address

Harry E. Jordan,
Room 601, 29 West 39th Street,
New York, N. Y.

P. A. Peterson, for 37 years associated with the Neptune Meter Co., and District Sales Manager of their Atlanta office, died on October 4th. He was an active member of the Association and a dependable worker in the Southeastern Section.

Frederick J. MacMullin, Resident Manager of the Atlanta plant and office of Paper Makers Chemical Division of Hercules Powder Company, died September 16th following a cerebral hemorrhage. He was 44 years old at the time of his death. Mr. MacMullin was well known to water works men in the southeastern states, having been engaged in the manufacture and supply of water purification chemicals for ten years. He was an active member of the American Water Works Association and was deeply interested in the affairs of the Southeastern Section since its formation in 1929. His time and energy were always available to sponsor any cause which contributed to the advancement of water works personnel. From its beginning the Georgia Water Works Short School has received unfailing support from him.

(*Continued*)

STANDARD METHODS FOR THE EXAMINATION OF WATER AND SEWAGE

EIGHTH EDITION

Public health workers and water works operators have bought 2100 copies of the Eighth Edition of this classic in four months.

That many people can't be wrong!

Perhaps the book is in demand because the fact is generally known that it has been completely rewritten and revised. Perhaps the knowledge that certain important undertakings in progress for some time were finally culminated and the results incorporated in the joint report has something to do with its popularity. Certainly it is the only publication of its kind and a definitely required item in the library of every person concerned with operation of water works and control of water supplies.

Standard Methods continues to be popular and is still available at $2.50 per copy.

THE AMERICAN PUBLIC HEALTH ASSOCIATION
50 West 50th Street **New York, N. Y.**

NEWS OF THE FIELD

Do water works men want publicity? That is a question hard to answer.

In these days of advertising, propaganda, publicity, or whatever you may wish to call it, it appears from time to time that men in the water supply field could benefit by organizing their publicity. A newspaper man once said that "if they want it printed, it's publicity; if they don't want it printed, it's news." But real publicity is a broader thing than that.

Actually, as some water utilities have learned, the real basis of all publicity is the service the customer gets. That word "service" includes quality, pressure, dependability, reasonable rates, courtesy and all that category of points at which the department touches the citizen. No amount of paid newspaper space will offset inferior quality of the supply or erratic service. No number of speeches made by a superintendent can undo the damage done by a discourteous meter reader. On the other hand, if the department gives good service and its key men are characterized by their integrity, a newspaper editor finds it difficult to campaign successfully against them.

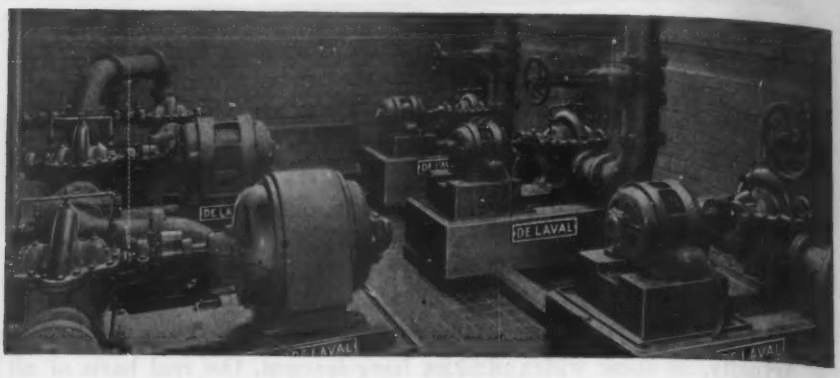
But there are ways of organizing the latent values of the automatic publicity into active support for or coöperation with the water works superintendent. The Los Angeles Department of Water and Power and the Indianapolis Water Company are examples for both the municipal and privately owned plants, where the property is large enough to organize its work under a trained publicity man.

The superintendent, at the other extreme, who has no appropriation for such purposes and who feels that there are some good things to be told about his department's work, can, under a scheme organized by one of the members of the Water Works Manufacturers Association, get some favorable newspaper publicity at practically no cost and with no obligation.

Material of the "clip-sheet" type has been prepared and the plan is outlined in such a way that the general story of water supply is tied in with local operations. Several water works men have received very favorable comments upon the manner in which the story was presented.

If any superintendent wishes to get the wheels turning in his direction, he can do it by giving the A.W.W.A. headquarters office his name and the name of the newspaper in his city most likely to coöperate. The name of an editorial friend on the paper would help. This information will be passed on to the proper organization and in due time, if previous experience holds good, the superintendent will find himself and his plant being fitted into a good newspaper story.

(*Continued*)



DE LAVAL PUMPS SAVE TAXES

for Weymouth, Mass.

The income from the Weymouth, Mass., water works has provided funds for the retirement of the original bond issue and all subsequent issues and has taken care of all charges for interest, depreciation, maintenance and operation, relieving the Town of any tax levy for this department.

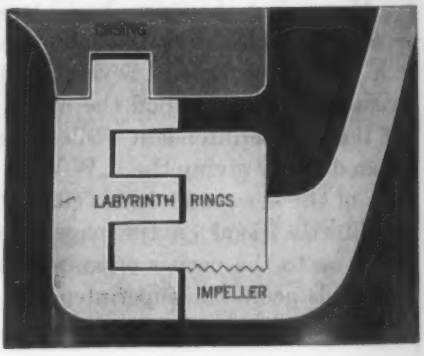
The pumping plant, as installed by the Turbine Equipment Co. of New England, comprises

7 DE LAVAL PUMPS

three of which are for low lift service and have capacities of 1000, 1250 and 1500 g.p.m., respectively, while three for high lift service have the same respective capacities, and the seventh, for wash water service, has a capacity of 250 g.p.m., all being driven by General Electric motors.

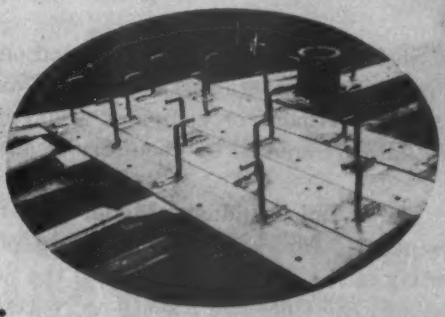
De Laval Pumps maintain their high initial efficiency. The *LABYRINTH WEARING RINGS* reduce leakage and protect the casing and impeller at the joints which separate the suction from the discharge chamber. For the same mechanical clearance, they permit only one-third as much leakage as does a flat joint and, because of the reduced leakage, they have a much longer life.

Engineers and others responsible for pumping plants will be interested in our publications "Sustaining Efficiencies of Centrifugal Pumps" and "Reducing the Cost of Operating Centrifugal Pumps;" sent upon request.



DE LAVAL STEAM TURBINE CO. Trenton, N. J.

For screens
Screen frames
Spillway fittings
Bolts
Valve stems, etc.

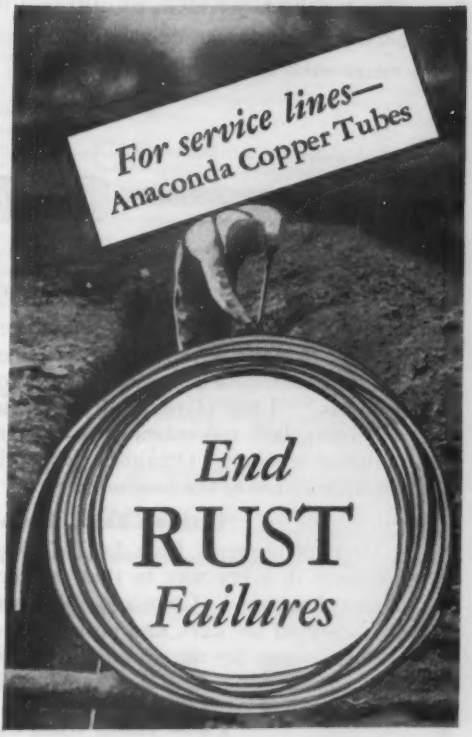


Non-Rust **EVERDUR** *Metal*
(STRENGTHENED COPPER)

ANACONDA METALS offer a permanent solution to corrosion problems, say the many engineers who have tried them.

EVERDUR* METAL is *rustless as copper... strong as steel... readily welded.* Since 1927, this durable copper-silicon alloy has demonstrated its value in many phases of reservoir and waterworks service.

ANACONDA COPPER TUBES put an end to the search for durable, trouble-free, cost-free service lines. They are ductile and easy to install ... no threading.



Anaconda Copper & Brass

THE AMERICAN BRASS COMPANY • *General Offices:* Waterbury, Conn.

*Trade-mark Reg. U. S. Pat. Off. *Offices and Agencies in Principal Cities* 27400

(*Continued from page 1*)

Such an experiment will be a good one for the man who wishes to sell his organization the idea that planned and persistent publicity on behalf of the department or company would do much to capitalize the good effect already created by good service and courteous personnel.

The Chemical Industry Medal of the Society of Chemical Industry was presented to Mr. E. J. Crane, Editor of Chemical Abstracts, at a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society on November 5, 1937, with Mr. James G. Vail presiding. The medal is awarded annually for valuable application of chemical research to industry and will be given this year to Mr. Crane for his work in abstracting technical and scientific writings in all fields of the chemical industry.

The Hobby Club idea, as outlined in the September Journal, is being discussed among the Association membership, but relatively few comments have come into this office.

(*Continued*)

DIFCO

The Detection of Coli in Water

Bacto-Endo's Agar

Bacto-Endo's Agar is widely used for confirming positive presumptive tests for *Escherichia coli* in water. When prepared for laboratory use this medium corresponds to Formula II of "Standard Methods of Water Analysis." Upon plates of medium prepared from Bacto-Endo's Agar *E. coli* forms dark red colonies with a metallic sheen which color the surrounding medium. Organisms which do not ferment lactose do not alter the appearance of the medium.

Levine's Eosin Methylene Blue Agar

Medium prepared from Levine's Eosin Methylene Blue Agar, Difco, conforms in every way to that recommended in "Standard Methods of Water Analysis." Colonies of *E. coli* developing upon the surface of this medium are dark and possess a metallic sheen while those of *Aerobacter aerogenes* are wine colored and have no sheen.

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media

DIFCO LABORATORIES
INCORPORATED
DETROIT, MICHIGAN

Before experimenting with any materials for underground mains—

CHECK THEM AGAINST THESE TEN POINTS OF PROTECTION

☐ ***Long Life:*** Has it long life? How long? In evaluating bids, cast iron pipe is universally figured at 100 years minimum.

☐ ***Internal Pressure:*** An average of many internal hydrostatic pressure tests on standard six-inch Class B cast iron pipe shows this pipe withstands more than 2100 pounds pressure per square inch. Another material failed at 290 pounds pressure per square inch.

☐ ***Tensile Strength:*** Routine specimens cut from standard Class B cast iron pipe show tensile strength ranging from 23,000 to 25,000 pounds per square inch. Another material shows a tensile strength of less than 2,000 pounds per square inch.

☐ ***Toughness:*** Under hydrostatic pressure and the impact of a 50 lb. hammer, ordinary cast iron pipe does not crack until the hammer is dropped four feet (beginning at one-foot with one-foot increases). Another material fails at one foot (beginning at three-inches with three-inch increases).

☐ ***Beam Load:*** Under beam stress tests, standard six-inch Class B cast iron pipe bears up under a load of 25,100 pounds and deflects approximately one-inch before breaking. Another material fails at 3760 pounds and deflects one-half inch.

☐ ***External Pressure:*** In regulation compression tests on a 12-inch section, standard six-inch Class B cast iron pipe withstands a crushing weight of 17,900 pounds. Another material fails at less than 4500 pounds.

☐ ***Imperviousness:*** The walls of cast iron pipe are impervious to leakage, seepage or sweating of water, gas or chemicals under internal hydrostatic pressure tests. Certain other materials are *not* impervious under similar tests.

☐ ***Tight Joints:*** For ordinary pressures, cast iron bell-and-spigot pipe—for high pressures, cast iron mechanical joint pipe—have stood the test of time and are known to be leak-proof. Certain other materials require joints yet to be proved.

☐ ***Tapping:*** Cast iron pipe taps cleanly with strong, tough threads, and loses little in structural strength. No other material withstands tapping as well.

☐ ***Flow Capacity:*** Under normal conditions, the flow capacity of cast iron pipe remains practically unimpaired for centuries. For the limited areas where active water is encountered, cement-lined or enamel-lined cast iron pipe is available. Under such conditions, no other material offers the combined long life and sustained flow capacity of lined cast iron pipe.

NOTE . . . ***Check each point only if you know the material in question meets the requirements with adequate margin of safety. If in doubt, find out before installing.***

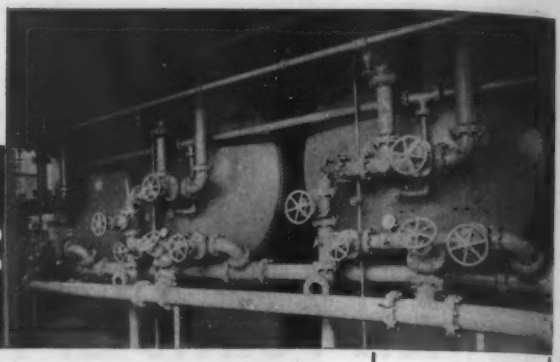
Some materials meet some and others meet others but only

CAST IRON PIPE

meets them all

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago

GENERAL STEEL PLATE CONSTRUCTION
GRAVER
TANKS
WATER CONDITIONING EQUIPMENT



DEPENDABLE

For three-quarters of a century, the Graver Organization has been designing, constructing, and erecting tanks and water treating equipment for municipalities and for industry.

Whatever your requirements, Graver can serve you most efficiently.

Send for Literature Today

GRAVER TANK & MFG. CO., INC.

75 Years of Dependable Service

New York, N.Y. East Chicago, Ind. Chicago, Ill. Catasauqua, Pa.

SETTLERS
FILTERS FOR MINERAL, TASTE, COLOR, ODOR REMOVAL
LIME AND SODA SOFTENERS
ZEOLITE SOFTENERS
IRON REMOVAL PLANTS
STERILIZERS

(*Continued from page 4*)

Paul Weir of Atlanta points out that "the preparation of educational displays for the advancement of general knowledge concerning the operation of and benefits derived by citizens from their respective water systems" should bring a number of men together in exchange of mutually interesting material.

He is right. It is a logical center of interest. Who, in the Association, is interested in the same activity?

Dr. Frank J. Tone, of the Carborundum Company, has been elected to receive the Perkin Medal of the Society of Chemical Industry for 1938. The medal is awarded annually for valuable work in applied chemistry and will be presented this year to Dr. Tone for his work in the development of abrasives and refractories. The selection is made by a committee representing the five chemical societies in the United States.

(*Continued*)

There MAY BE TROUBLE AHEAD

TROPICAL STORMS racing up the coast line are the forerunners of winds that de-nude the trees, blowing dead leaves into streams, reservoirs, etc.

To the Water Works personnel this means only another source of taste and odors.

The alert Plant Operator is prepared with a larger supply of Activated Carbon, ready to step up the dose to take care of the increased tastes and odors.

The Plant Operators have found that the furnishing of a palatable drinking water through the use of Activated Carbon so enhances the prestige of the Water Department, that it is now being used the year around.

The cost of furnishing palatable drinking water through the use of Activated Carbon is so negligible that no justification exists today for not furnishing a drinking water suitable "to the King's taste."

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

230 Park Avenue
New York, N. Y.

417 Schofield Building
Cleveland, Ohio

205 West Wacker Drive
Chicago, Illinois

(*Continued from page 8*)

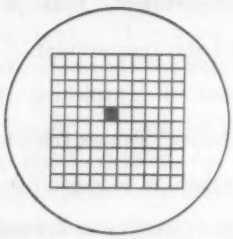
Abel Wolman is now president-elect of the American Public Health Association. He was chosen for this office at the New York meeting of the Association, which registered 3,549 in attendance—the largest meeting of record.

Parallel to Wolman's activities in the American Water Works Association have been his contributions to the progress of the A.P.H.A. As chairman of that association's Committee on Research and Standards, he has guided its committee work along constructive and fruitful lines. It is entirely proper that the leader of an organization's research program should be honored by its presidency.

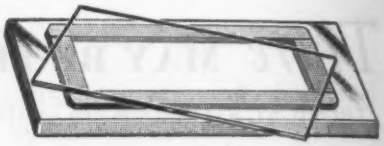
Covers for Association Journals from 1914 through 1923 are available (30¢ each) to any one who may as yet have these years' issues unbound and wish to give them added protection. The cover, with the issues pertaining to it, can be sent to any book-binder and the binding completed at a small cost.

(*Continued*)

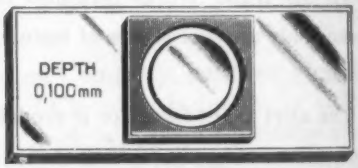
MICRO-ORGANISM COUNTING APPARATUS by HELLIGE



MICROMETER (Whipple), for counting micro-organisms in water. The large area is divided into 100 small squares, one of which is divided into 25 squares.



SEDGWICK-RAFTER CELL, Hellige all-glass type with *fused-on* glass frame, more durable than common cells fabricated with soft cement and far superior to the original model having brass frame.



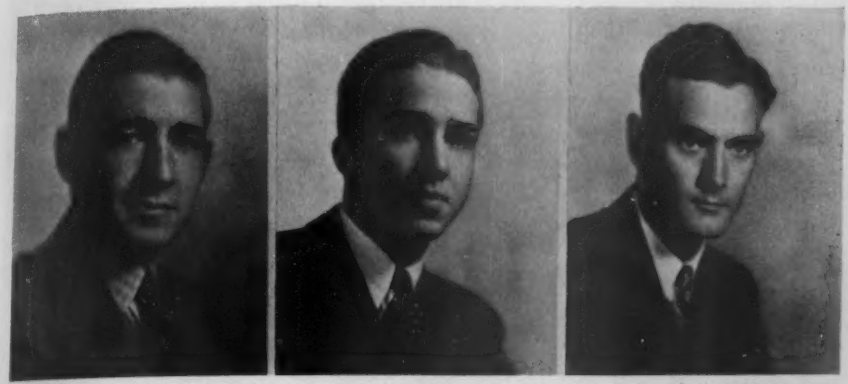
COUNTING CHAMBER, Howard, consisting of heavy glass slide with polished disc, surrounded by 0.1 mm. higher square glass cell, forming chamber 0.1 mm. deep when cover glass is placed on the cell.

Write for Bulletin No. 612, on Apparatus and Equipment for the Analysis of Water, Sewage, and Industrial Wastes

HELLIGE, INC. 3718 NORTHERN BLVD. LONG ISLAND CITY, N.Y.

WE of ACTIVATED ALUM CORP. *say:*

"Thank you very much!"



FRED E. STUART, *President* — ALBERT C. BRUMLEY, *Vice-Pres. & Treas.* — BURTON W. GRAHAM, *Chief Chemist*

We sincerely appreciate your switching to Blackalum and Standard Activated Alum. Used in sixty-one (61) plants in sixteen (16) states.

We want to tell you that the development work we are now conducting will be passed on to you in our products—at no extra cost.

To those not using Blackalum or Standard Activated Alum—

DO YOU KNOW• "That in dollars and cents in plant operation these Alums Produce the best water."

DO YOU KNOW• "They are now used by the biggest names in water treatment practice."

DO YOU KNOW• "They are used by the Government."

DO YOU KNOW• "They are recommended by leading consulting engineers."

DO YOU KNOW• "That we guarantee their Performance."

Why not give them a trial at your plant because it is being said—

•

DO NOT SIGN YOUR NEXT YEAR'S ALUM CONTRACT UNTIL YOU HAVE TESTED OUR ALUMS AND RECEIVED OUR PRICE QUOTATIONS.

"You Get the Best Coagulants from Activated Alum Corp."

Activated Alum Corp.

OFFICE
80 Broad Street
New York City, N. Y.

WORKS
Curtis Bay
Baltimore, Maryland

(*Continued from page 10*)

Thirty-six states, at the end of September, had enacted laws or established plans for full participation in the federal social security program.

Thirty-four million account numbers had been assigned and 295 field offices had been established to care for the work. Needy aged to a total of 1,469,700 were receiving an average of $18.54 per month; 30,000 needy blind persons were receiving an average of $24.66 per month; 487,500 dependent children in 196,100 families were being assisted at an average cost of $30.74 per family. The three groups—old-aged, needy-blind and dependent-children—total almost 2,000,000 persons.

The Carnegie-Illinois Steel Corporation will build a complete water works system for the new Irvin Works between Dravosburg and Clairton. The contract, on which The Rust Engineering Company is both designer and contractor, will call for an expenditure of approximately $800,000.

It will be one of the large water works built purely for industrial use and will have an initial capacity of 36,000,000 gallons per day, with provision made for an ultimate capacity of 72,000,000 per day.

(*Continued*)

CONTINUOUS DUTY GAS ENGINES
HOLD THE RECORD FOR LOW COST POWER

In the mid-continent enough gas is being wastefully burned to supply you with cheapest power. Surplus gas is being collected and distributed by pipe line, and Sterling Gas Engines are available at lowest cost, with many advantages, to utilize this fuel.

Semi-portable 8-cylinder 400 H.P., 900 R.P.M. Gas Engine, direct connected to 200 K.W. Electric Machinery and Manufacturing Company generator and mounted on welded steel skid for oil field power.

Home Office and Plant
1270 Niagara Street
Buffalo, N. Y.

STERLING ENGINE COMPANY
Dept. C-3

Branch Office
900 Chrysler Bldg.
New York, N. Y.

How Old are Your Pumps?

AVERAGE efficiencies for centrifugal pumps have increased from 10 to 15% since 1914 and 5 to 8% since 1924 due to higher speeds and better hydraulic design. For this reason many cities are saving money by scrapping old units and replacing them with modern high-efficiency types. The economy usually attributed to units four or five times as large, only a few years ago, was realized on the acceptance test of the moderate size, geared, steam turbine driven, Allis-Chalmers centrifugal pumping unit shown above.

This unit, although rated less than five million gallons per day and operated by a condensing steam turbine with approximately 150 lbs. steam pressure and no superheat, delivers over 3000 gallons of water per minute against 210 feet head and uses less than 3000 lbs. of steam an hour which is exceptionally good performance for a unit of this size. It is another example of Allis-Chalmers "Undivided Responsibility", pump, turbine and condenser built by one company.

EQUIPMENT ENGINEERS TO INDUSTRY

ALLIS·CHALMERS

MILWAUKEE WISCONSIN

(*Continued from page 12*)

Water will be taken from the Monongahela River through a reinforced concrete open intake 27 feet wide and nine feet deep. Trash gates at the entrance will remove heavy refuse, while traveling screens will pick up light refuse, such as leaves.

A primary lime treatment system will be provided to neutralize the acid content of the water. The rate of feeding the lime will be automatically controlled in accordance with the change in the volume of water pumped and changes in the acid content.

The pump room has been arranged for the immediate installation of three pumps with a capacity of 8,500 gallons per minute with space provided for the future installation of three additional pumps.

After passing through the pumps, the water will go through automatic strainers to remove all foreign matter .024 inches in diameter or larger, thence to a balancing reservoir.

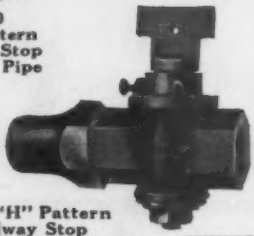
Part of the water will be delivered directly from the reservoir in a raw state for descaling and cooling. Water requiring further refining will run through an all-steel filtration plant of the Morse type using line coagulation equipment and gravity sand filters.

(*Continued*)

KITSON

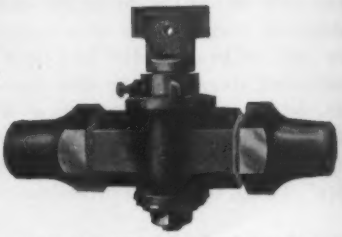
FULLY GUARANTEED for freedom from leakage and ease of operation

C-190 "H" Pattern Ovalway Stop For Iron Pipe



C-192 "H" Pattern Ovalway Stop Inlet Copper Pipe Coupling Outlet For Iron Pipe

OVALWAY —STOPS—



C-194 "H" Pattern Ovalway Stop Copper Pipe Couplings Both Ends

KITSON COMPANY

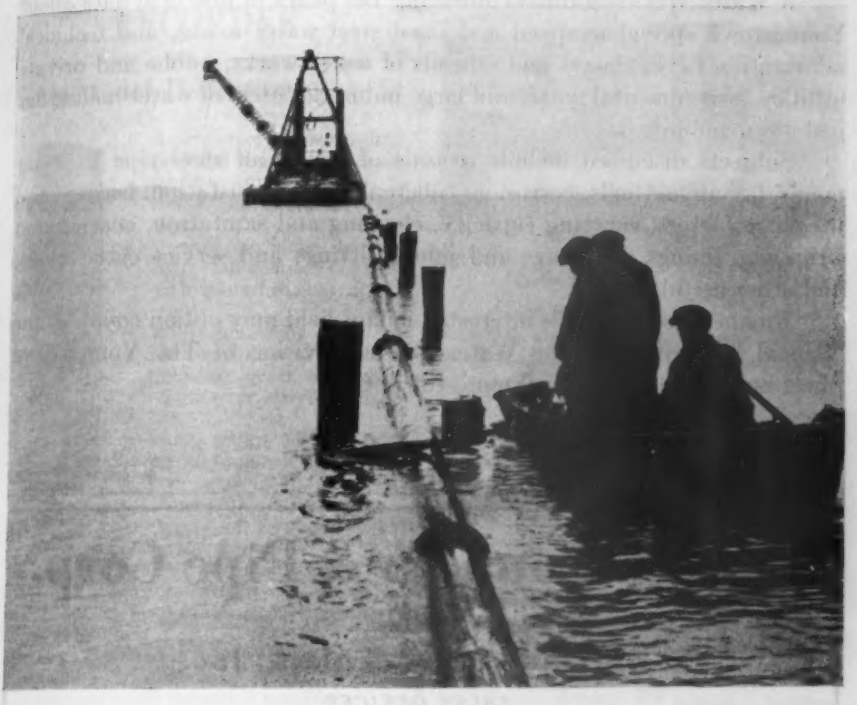
2409-15 WESTMORELAND STREET

PHILADELPHIA, PA.

Manufacturers of: Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters . . . Quality Brass Goods for Gas, Water and All Plumbing Uses.

LOOK

AT THESE ADVANTAGES



OF ARMCO SPIRAL WELDED PIPE

Wall Thicknesses and Coatings Designed for Individual Requirements • Low First Cost • Low Installation Cost • No Sudden Rupture or Breakage • High Flow Capacity • Reduced Leakage • Wide Range in Diameters • Adaptable to Standard or Special Fittings • Call in an experienced Armco pipe man, or write for information bearing on your needs. The American Rolling Mill Company, Pipe Sales Division, 904 Curtis St., Middletown, Ohio.

ARMCO

CUSTOM BUILT FOR WATERWORKS USES

(*Continued from page 16*)

Methods of sampling and analyzing coal and coke have been revised by an A.S.T.M. committee. Water plant operators who are interested in routine control of their coal purchases may obtain the text (K18–1933) from the A.S.T.M. office in Philadelphia.

A Water Works Manual embracing 120 pages of practical data about Youngstown special wrapped and lined steel water mains, and technical information for engineers and officials of water works, public and private utilities, governmental units, and large industrial users of water mains, has just been published.

Subjects discussed include records of service of steel pipe in water mains, laying methods, corrosion, tuberculation, incrustation, leakage and breakage factors, carrying capacity, cleaning and sanitation, coating and wrapping, linings, couplings and joints, fittings and service connections, and other useful data.

Engineers and officials interested in this field may obtain copies of the Manual by writing to the Water Works Division of The Youngstown Sheet and Tube Company, Youngstown, Ohio.

(*Continued*)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
75 FEDERAL ST., BOSTON, MASS.

Manufacturers of

CAST IRON PIPE

Sizes 2″ to 84″

Flanged Pipe ***Flexible Joint Pipe***

Bell and Spigot Pipe

Special Castings ***Short Body B. & S. Specials***

Warren (W) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

TYPE M

MODEL D

REGISTER - INDICATOR RECORDER

New Model D Features:

1. Retention of previous sturdiness and simplicity plus numerous improvements in mechanism and general design.
2. Twenty-one inches of mercury differential capacity with powerful float actuation.
3. Wider measuring range.
4. No possibility of air trapping; air vents at highest points over mercury chambers
5. Easily set up, adjusted, and placed in operation.
6. Long, separate Indicator dial at eye level; no "stooping."
7. Entire chart record of flow rate visible from front of instrument.
8. Six-dial Totalizer, 4½" diameter.
9. Chart and Totalizer driven by electric motor or mechanical clock movement, as selected.
10. Dials mounted in neat steel cabinet with modern "switchboard" effect. Wall or separate panel mounting possible.
11. Indicator and Totalizer dials of white pyralin and all dials *illuminated* from the interior. Main case finished in black and embellished with chromium strips. An addition to the appearance of any plant.
12. Chronoflo long distance transmitting and summation attachments now available.

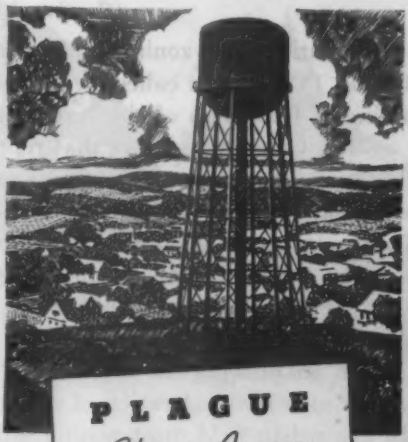
Write for new Bulletin 291

VENTURI

"VENTURI"—Registered

BUILDERS IRON FOUNDRY

9 CODDING ST., PROVIDENCE, R. I.



Plagues seldom terrorize communities and cities nowadays. Health authorities everywhere have long since recognized the true value of water chlorination in relation to plagues. Modern water purification plants in charge of competent engineers, chemists and waterworks men are standard equipment in nearly every state, city or township in the country.

Solvay's "Big 3" Service is a service system that insures *quick* and *adequate* supplies of Liquid Chlorine to state and municipal water purification plants. It is a service on which water-works men can always depend for Liquid Chlorine supply . . . *and* for advice and technical assistance when required.

Solvay Liquid Chlorine shipments are now routed from Syracuse, New York, and Hopewell, Virginia. Upon announcement during the early part of 1938 shipments will be made from the new Baton Rouge, Louisiana, Liquid Chlorine plant. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Write to

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 RECTOR STREET NEW YORK

SOLVAY

LIQUID CHLORINE

(*Continued from page 18*)

A nation-wide zoning conference to be held in Chicago on December 13 and 14 has been called by Secretary of the Interior Harold L. Ickes, acting as Chairman of the National Resources Committee.

The Committee hopes that representatives of city and county zoning commissions and planning boards as well as State Planning Boards, Federal Bureaus and unofficial groups will attend. The purpose of the Conference is to consider zoning problems and practice at all levels of government in the hope that general adoption of modern and practical methods may be stimulated. All phases of the question will be discussed by experts in the various fields.

In announcing the Conference, Secretary Ickes said: "A demand for a thorough reconsideration of zoning problems has existed for some time. In the urban field most zoning ordinances are from ten to fifteen years old and a great number of communities are contemplating revision in the light of recent knowledge and experience. A zoning conference can be a great help to these communities and to others who may decide upon revisions in the future through frank discussion of common problems and ways to meet them. While rural zoning is a comparatively new field there are many problems of better land use concerning which it will be valuable to define objectives and policies. Another subject which will come in for serious discussion is the desirability of zoning of flood plains

(*Continued*)

The fire hydrant for present-day service and traffic conditions

THE Kennedy SAFETOP meets every requirement of strength, safety and economy as well as instant readiness and reliability in service.

It is strong enough to resist any ordinary impact; but if broken by a collision which *no* hydrant could resist, it is speedily and economically returned to service, without excavation or shutting off the water supply.

Its easy elbow and nozzle curves and its extra-large standpipe assure minimum pressure loss; and its simple, straight-line operating mechanism assures positive operation without danger of sticking.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY
SAFETOP
REG. U.S. PAT. OFF.
FIRE HYDRANT

13 CONTRACTS TO ALCO TO FURNISH STEEL WATER PIPE FOR THE NATION'S CAPITAL

Cities Using ALCO STEEL PIPE Include the Following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W. Va.
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y.
New Brunswick, N. J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

Approximately 15,000 ft. of 30", 36" and 48" Alco Steel Pipe for the District of Columbia Water Department.

A *dozen* repeat orders for Alco Electric Welded Steel Pipe have been received from the District of Columbia since the first installation in 1932. This preference, however, is not confined to Washington, D. C., for water works engineers everywhere heartily indorse these

SPECIFIC ALCO FEATURES

- Greater Strength
- Longer Life
- Smoother Waterway
- Longer Lengths
- Fewer Field Joints
- Low Initial Cost
- Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS, INCORPORATED

30 Church Street — New York, N. Y.

CHICAGO WASHINGTON HOUSTON TULSA

Plants at Dunkirk, N. Y., and Montreal, Canada — Cable Address: Alproducts

DIVISION OF AMERICAN LOCOMOTIVE COMPANY

(*Continued from page 20*)

for the prevention of unwarranted investments some of which might lead to further demands for flood protection at public expense."

After a two-day discussion of the general subject a final discussion will summarize the findings of the Conference on rural, urban, flood, plain and recreational zoning and will present "a positive program for zoning."

Now is the time to organize the program for the 1938 convention. It is also the time for the A.W.W.A. member to tell us what subjects he feels should be discussed in that program. Are you one of those who felt that the program last year or the year before did not cover things in which you were interested or omitted things of real value to water works men? If you did, you are hereby urged to record with Linn Enslow (Chairman of the Publication Committee) or with A.W.W.A. headquarters just what you feel should be done to make the 1938 program better than ever.

(*Continued*)

WHITE
FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

Check LUDLOW *Hydrants*

Check these points about the Ludlow No. 90 hydrant—

√ Full force—no obstruction in waterway
√ Non-freezing—drains from bottom
√ Surge and water hammer eliminated
√ Replaceable without digging
√ Parts easily removable—low maintenance
—and finally, the most modern, graceful design obtainable. Send for free folder.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

Ring in Health!

Protect Your Home from Tuberculosis
with CHRISTMAS SEALS

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg — Indiana

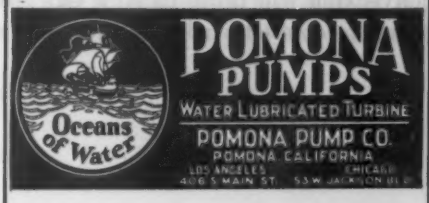
WELL SCREENS

To meet your problems in sand and gravel wells.

EDWARD E. JOHNSON, INC.
2304 Long Avenue,
St. Paul, Minn.

SAVE 80% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

10 DIFFERENT SIZES TO FILL EVERY NEED
WRITE FOR CATALOG
Dept. P-3
GIANT MFG. CO.
Council Bluffs, Iowa



Index to the Proceedings, Journal and Other Publications of The American Water Works Association from the Founding of the Organization. 1881–1933

This book opens the door to an immense store of knowledge covering studies, problems and experiences of hundreds of water works superintendents, engineers, scientific specialists, etc., during the past fifty-three years.

It is well bound in buckram, with stiff covers, and contains 233 pages. The price is $1.50 per copy to members and $2.50 per copy to non-members, postpaid.

Order from AMERICAN WATER WORKS ASSOCIATION
29 W. 39th St., New York, N. Y.

(*Continued from page 22*)

The Roosevelt Hotel has been selected as headquarters for the 1938 A.W.W.A. convention at New Orleans. The official dates for the convention are April 24th to 28th. The first event officially scheduled is the meeting of the Board of Directors at 8 p.m. on Sunday evening (the 24th) and the final one is the dinner-dance scheduled for 7 p.m. on Thursday evening (the 28th). Between those two events will be jammed the usual amount of technical program, exhibits, entertainment and conversation that is found at an A.W.W.A. meeting. The unusual setting of New Orleans, with its French quarter and food of flavors never met before, will add much to the normal pleasures of an association convention.

The convention is set just one week after Easter—early enough in the season to escape too much heat yet late enough to let the Northerner get his first glimpse of green leaves.

Judging by the fact that reservations already total more than 150, attendance at the meeting will be large. Members are urged to make their reservations promptly. Rates at the Roosevelt range from $3.50 per day for single rooms with bath to $9.00 per day for twin-bedded rooms. Rooms at lower rates can be found in other satisfactory hotels. Neither the Roosevelt nor any other single hotel in New Orleans has the capacity of the Statler where our Buffalo convention was held. But the Jung, the De Soto, the New Orleans and other hotels shown in the map on page 33 are able collectively to accommodate more people than our convention will bring to New Orleans and they are close enough together to make contact with our meetings and other functions very easy.

(*Continued*)

(*Continued from page 28*)

Charles R. Bettes, for many years chief engineer of the Long Island Water Company and a resident of Far Rockaway, Long Island, died on October 29th. He had been a member of the A.W.W.A. since 1901 and at various times a member of the Board of Trustees and of the Executive Committee of the Association.

A distinct loss has been suffered by the entire Association and especially by the Canadian Section because of the death of J. J. Salmond, of Toronto, on November 4th. He had been in apparent good health up to the time of his death. He was another victim of coronary thrombosis—the modern disease of the active man of middle years.

He had been for many years president and general manager of the "Canadian Engineer." His membership in the Association dated from 1907 and he had been active in the affairs of the Canadian Section from the date of its organization.

He represented the Canadian Waterworks Equipment Association on the Section's executive committee. A valuable and energetic worker in the association field, his counsel and cooperation will be missed by his associates.

August G. Nolte, of St. Louis, died on October 14th. He was well known to Association men in the Middle West. Many of his active years were spent in the purification plants of the St. Louis municipal water Department.

At one time he superintended water treatment in the Panama Canal Zone. At the time of his death, he was a member of the staff of the State Sanitary Engineer of Missouri and was Secretary of the Missouri Water and Sewerage Conference.

Joint Session A. S. M. E.-A. W. W. A.

December 9, 1937

Engineering Societies Building, New York

WATER HAMMER IN WATER-WORKS SYSTEMS

Malcolm Pirnie, Presiding

Complete Characteristics of Centrifugal Pumps and Their Use in the Prediction of Transient Behavior, by R. T. Knapp.

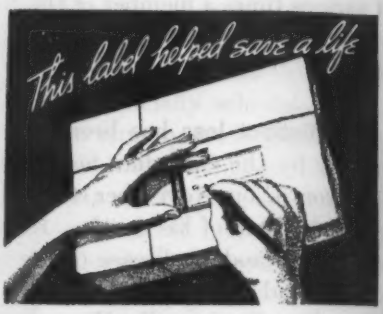
Comparison Between Calculated and Test Results on Water Hammer in Pumping Plants, by O. Schnyder.

Air Chambers and Valves in Relation to Water Hammer, by R. W. Angus.

Water-Hammer Tests on Transite Pipe, by L. H. Kessler.

Water-Hammer Problems in Pumping Plants, by R. M. Peabody.

Tests on Water Hammer in Pump-Discharge Lines, by E. Bruce Ball.



140,000 PERSONS

. . . men and women, die annually of cancer. Yet cancer, if discovered in time, can be cured . . . Purchase the label shown above, place it on your Christmas packages, and join one of the greatest crusades of our times: the fight against ignorance and fear of cancer. Help spread our message by doing your part . . .

FIGHT CANCER WITH KNOWLEDGE

WHAT YOU CAN DO TO HELP. Send $1.00 to the New York City Cancer Committee, 165 East 91st Street, for 10 labels and 1 year's subscription to the new publication "The Quarterly Review." If you live outside the city, write to New York State Cancer Committee, Rochester, N. Y.

THE NEW YORK CITY CANCER COMMITTEE

NEWS OF THE FIELD

Water Department employees have not often experienced, as have employees of many industrial plants, the adventure of rating the qualities of their associates or being rated by them.

By the word 'rated' is meant that form of semi-statistics which lists the various qualities that an individual is presumed to need in the work he is doing and asks that the items or phrases most aptly describing the personality being studied be so marked. Then someone in authority applies standard factors to build up a grade or percentage figure. This is used as a periodical development (or retrogression) record of the individual and as a basis of preference in selection for promotion.

The Servel Company, of Evansville, Ind., manufacturers of the Electrolux refrigerator, in order to improve the efficiency of workers, in 1934 instituted a program of foreman training conferences. H. L. Humke, Director of Education for Servel, in a recent issue of "Executives Service Bulletin" tells some of the things that developed in these conferences:

"The first series of conferences, based on management of men, had an interesting background because of the fact that efficiency ratings, called 'promotion ratings,' had been made during the preceding summer of all employees in the plant—approximately 5,000. The distribution of ratings for the entire organization and for the separate departments raised such questions as relative values of workmen, types needed for different jobs, and individual differences found among the men rated. The problem of the foreman's ability to rate men, and his problems of managing the men in his department, received considerable attention.

"Discussion of the foreman's problems in managing his department and his men led to suggestions that the foremen should know more about managing themselves. The question of the influence of the foreman upon the people with whom he associated and the problems of characteristics, abilities, and traits affecting others were all brought out in the meetings. At the close of the second year of conferences the foremen were asked to assist in selecting a theme for the next year's meetings. After preliminary discussions of several possible subjects, 75 percent of the foremen voted in favor of a study of 'The Foreman and Personality.'

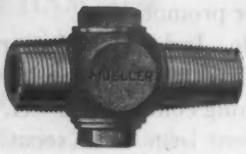
"A summary of general problems dealing with personality was prepared for preliminary summer conferences with the superintendents and top foremen who were to serve as conference leaders. From these discussions, preliminary text material was written and criticized by the conference leaders.

"During the winter of 1936–1937 six conference groups composed of

(*Continued on page 4*)

MUELLER

CURB AND CORPORATION STOPS
FOR
COPPER
LEAD
IRON



All Mueller Stops are engineered strictly for their particular type of connection, being scientifically designed to give them strength where it is needed most. You will find that Mueller Stops have extra large wrench surfaces, heavy metal walls, extra long skirts on the nuts, and accurately ground keys that insure a pressure-tight seat.

All of these factors have a very important bearing upon installation and maintenance costs, so do not over-look them when you order YOUR Stops. Specify MUELLER and be sure of long trouble-free service.

MUELLER CO.
DECATUR ILLINOIS

Factories: Decatur, Ill., Chattanooga, Tenn., Los Angeles, Calif., Sarnia, Ont.
Branches: New York and San Francisco

Replace rusted-out pipe ONCE – and NO MORE!

Anaconda Copper Tubes answer your problem...because they are...

[1]
Easy to install. Flexible, easy to bend; no threading.

[2]
Long lengths. Coils up to 60 ft.

[3]
Durable. Cannot rust.

[4]
Ductile. Freezing hazard is minimized.

[5]
Moderate in cost. The most economical material in the long run.

Leading supply houses carry Anaconda Copper Tubes in coils up to 60 feet. The name Anaconda stamped at regular intervals makes identification easy.

ANACONDA

3773

Anaconda DEOXIDIZED Copper Tubes

THE AMERICAN BRASS COMPANY, *General Offices:* Waterbury, Conn.

Offices and Agencies in Principal Cities. In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

(*Continued from page 1*)

125 men developed the accompanying personality rating sheet, 'Leadership Standards for Analyzing Foremen.' (See page 8)

"Throughout the conferences the definition for the term personality was, 'One's influence upon others.' The problem in which the foremen were concerned was primarily their influence upon the persons connected with their particular jobs, so the various abilities, traits, habits, and attitudes necessary or demonstrated on the job were the ones discussed. Ten traits were chosen as being of basic importance, but no effort was made to weigh their relative importance. As these traits were discussed, they were broken down into trait actions, grouped to show variations. It was assumed that a man having many traits rated in the "D" group would not be retained in a supervisory position. This sheet was carefully revised by members of the conference group, and then tried out in actual use.

"Each foreman submitted a list of names of persons to rate him. From this list a random selection was made and a copy of the analysis sheet sent to each for rating. The rating was done by men who work for the foreman, his associates, and his superiors. Accompanying the analysis sheet were instructions for the rating, among these being:

(*Continued on page 6*)

Specify **LUDLOW**

Sewerage and Filtration Equipment...

Specify Ludlow gates and valves for trouble-free performance. They are available in all types and sizes—and conform to A.W.W. Association standards. Write for information and quotations.

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

OVER 500 municipalities use American or New York Continental Jewell Water purification equipment.

WATER FILTERS
WATER SOFTENERS

Proportionate Electro-Magnetic Chemical feeders for feeding lime, acid, alum, soda ash, etc.

AMERICAN WATER SOFTENER COMPANY
Lehigh Avenue and 4th St.
Philadelphia, Pa.

WHEN SHOWERS DON'T SHOWER

"What ails this shower? All it does is dribble!" yells Mr. Citizen. "Don't I know it?" echoes Mrs. Citizen. "All the neighbors are complaining."

* * *

"What ails our water pressure, Joe?" says the Mayor to the Water Commissioner. "Pressure's okay at the pumping station," retorts the Water Commissioner. "Trouble is the water is hard—chokes household water heaters and piping with scale. As I've told you before, we need a Permutit municipal water softener."

* * *

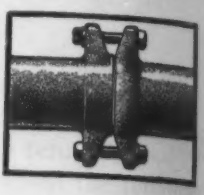
Don't wait until the house piping of your citizens is ruined. Don't wait until public protest becomes peremptory. Act now. Save money for your citizens. Save soap. Save work and discomfort. Investigate Permutit municipal water softening systems. Write for complete data—estimates—references. Address your inquiry to The Permutit Co., Dept. G2, 330 West 42nd St., N. Y. C.

Permutit

Water Conditioning

UNIVERSAL CAST IRON PIPE

LAID WITH JUST WRENCHES



No other tools are needed. No lead, no pouring, no bell holes to dig. Machined iron-to-iron flexible joints. SPEEDIEST...EASIEST ...SAFEST. Highest quality Cast Iron.

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General Offices: 386 FOURTH AVENUE, NEW YORK

CHICAGO, ILL., 1105 W. 36th St. - OAKLAND, CALIF., 275 Fourth St.

OFFICES IN PRINCIPAL CITIES COAST TO COAST

(*Continued from page 4*)

1. Keep in mind the relationship to his job of the personality of the person to be analyzed—how he affects others.
2. Keep all matters in connection with this task scrupulously private.
3. Make your analysis promptly. Do not sign the sheet.
4. If you do not desire to give an analysis, write across the face of the sheet, "Wish to be excused."

"Perhaps the final form of 'Leadership Standards for Analyzing Foremen' is not so complete, comprehensive, or accurate as it might be. However, it was felt that the sheet would have greater value and would be regarded with more respect by the foremen if it were left exactly as they had decided upon it.

"So far, 121 men have asked for analysis. This means that 863 employees, including men who work for the foreman, men who work with him, and men for whom he works, have filled out an analysis blank. Up to date, 744 analyses have been returned to the education office and forwarded to the foremen who wished to have the benefit of analysis by others.

(*Continued on page 10*)

FIRST QUALITY METERS EXCLUSIVELY

SPECIFY *American or Niagara*

(BRONZE CASE) (IRON CASE)

Water Meters

WRITE FOR CATALOG

BUFFALO METER COMPANY

Established 1892 2914 Main St., Buffalo, N. Y.

13 CONTRACTS TO ALCO TO FURNISH STEEL WATER PIPE FOR THE NATION'S CAPITAL

Cities Using ALCO STEEL PIPE Include the Following:

Auburn, N. Y.
Birmingham, Ala.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Clarksburg, W. Va.
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Fairport, Ohio
Fort Wayne, Ind.
Elizabeth, N. J.
Hartford, Conn.
Manitowoc, Wis.
New York, N. Y.
Niagara Falls, N. Y.
New Brunswick, N. J.
Ogden, Utah
Philadelphia, Pa.
Salamanca, N. Y.
Washington, D. C.
Wilmette, Ill.

Approximately 15,000 ft. of 30", 36" and 48" Alco Steel Pipe for the District of Columbia Water Department

A *dozen* repeat orders for Alco Electric Welded Steel Pipe have been received from the District of Columbia since the first installation in 1932. This preference, however, is not confined to Washington, D. C., for water works engineers everywhere heartily indorse these

SPECIFIC ALCO FEATURES

- Greater Strength
- Longer Life
- Smoother Waterway
- Longer Lengths
- Fewer Field Joints
- Low Initial Cost
- Ultimate Economy

Alco Electric Welded Steel Pipe is supplied in diameters from 18" to 120"

ALCO PRODUCTS, INCORPORATED

30 Church Street — New York, N. Y.

CHICAGO — WASHINGTON — HOUSTON — TULSA

Plants at Dunkirk, N. Y., and Montreal, Canada — Cable Address: Alproducts

DIVISION OF AMERICAN LOCOMOTIVE COMPANY

Leadership Standards for Analyzing Foremen

Name _____ Dept. _____ Date _____

Traits	A	B	C	D
Physical Condition	Radiates vigor Keeps in trim Works without exhaustion	Strength adequate for job Absent occasionally	Easily exhausted Irregular attendance	Lacks energy Attendance uncertain
Speech	Speaks effectively Is tactful Concise and to the point	Speaks naturally and convincingly Uses good English	Limited vocabulary Unnecessarily profane	Talks but says nothing "Windy," "gossipy"
Intellect	Quick reliable decisions Keen thinker Solves own problems	Careful thinker Knows facts Needs some instructions	Shows reasoning power Must have instructions	Makes no effort to learn Never solves own problems Indifferent to information
Attitude Toward Job	Keen interest in job Sincere in his work Loyal to superiors	Attentive toward job Considers suggestions	Indifferent toward job Cooperates under pressure	Is not interested Given to destructive criticism Is "sour" on job
Emotional Balance	Calm during crisis Never loses his temper Has patience	Has self-control Feelings are not easily hurt	Easily excited Moody at times	Uncontrolled temper Easily angered Nervous and irritable
Leadership Qualities	Always willingly obeyed Gets full cooperation Gains confidence and loyalty	Inspires others Influences others Is patient with others	Does not gain full cooperation Doesn't always get results	Drives his men Arouses antagonism Grudgingly obeyed
Aptitude For Job	Competent and inventive Expert in his work Gets quantity of quality	Has ability to do job Good judge of work Has initiative	Has few practical ideas Requires some training Uses experience poorly	Untrained for job Has poor working habits
Appearance	Dresses to suit job Has a pleasing manner Always clean (as job permits)	Generally neat Clean appearance	Not pleasing Careless at times	Dirty, slovenly Very careless
Regard for Others	Strives to help others Respects workers' views Shows politeness expected	Cooperates willingly Considers workers' problems Is not partial	Just arbitrates Shows indifference Shows some partiality	Is unreliable Works against associates Does not cooperate
Disposition	Friendly to all Is liked by everyone Inspires confidence	Has sense of humor Pleasant to work with Is well liked	Easily disturbed Selfish Has no sense of humor	Quarrels frequently Antagonistic Grouchy

Analyze, in relation to his job, the individual whose name appears above by:
(a) *Underlining* each statement which you think describes the individual.
(b) Placing a check (✓) in the rectangles which contain the statements of traits which best describe the individual.

TO ALL OF OUR MANY FRIENDS IN THE WATER FIELD

Greetings

AS another year is approaching to its close, we soon will hear again the beautiful age-old message of "Peace on Earth, Good Will Toward Men." In the world of today, we can all earnestly hope that such sentiments will remain in the hearts and minds of all peoples.

May we express to you our greatful thanks for your kindly consideration and co-operation in our efforts to be of service; also for the many friendships that we are privileged to enjoy amongst you.

That your troubles be small, and your blessings large, is our heartfelt desire, in wishing you a Happy Christmas Tide and a New Year filled with good health and prosperity.

Sales Manager

INDUSTRIAL CHEMICAL SALES
DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

1002 Lincoln Ave.	230 Park Avenue	417 Schofield Bldg.	205 W. Wacker Drive	315 Burke St.
Tyrone, Pa.	New York, N. Y.	Cleveland, Ohio	Chicago, Ill.	Easton, Pa.

(*Continued from page 6*)

"Since the program has been in effect, men who did not attend foreman conferences are requesting that sheets be sent out for analyses of themselves, stating that any man can profit by knowing what others think of him."

There is something about this that appears to have value in water department personnel work. After a brief study of the rating sheet, ask yourself the question—"Is there not some modification of this which I can develop as a means of appraising the qualities of the men in my organization?"

Take the meter reader for example. There is a man who comes in contact with hundreds of customers every month or quarter. Is he neat or slovenly? Is he antagonistic or friendly? Does he have the sum of qualities needed for meter reading? Is it not better to appraise his qualities by routine and organized method rather than by the chance method of an angry dismissal? Perhaps he is not a meter reader. The old saw about square pegs in round holes has its application to water department employees.

(*Continued on page 12*)

WHITE FILTER SAND
98% Pure Silica

●

Washed, Screened and Dried. No Freight on Moisture—Prompt shipment in Bags or paper lined Box Cars—Write or wire us for information and prices.

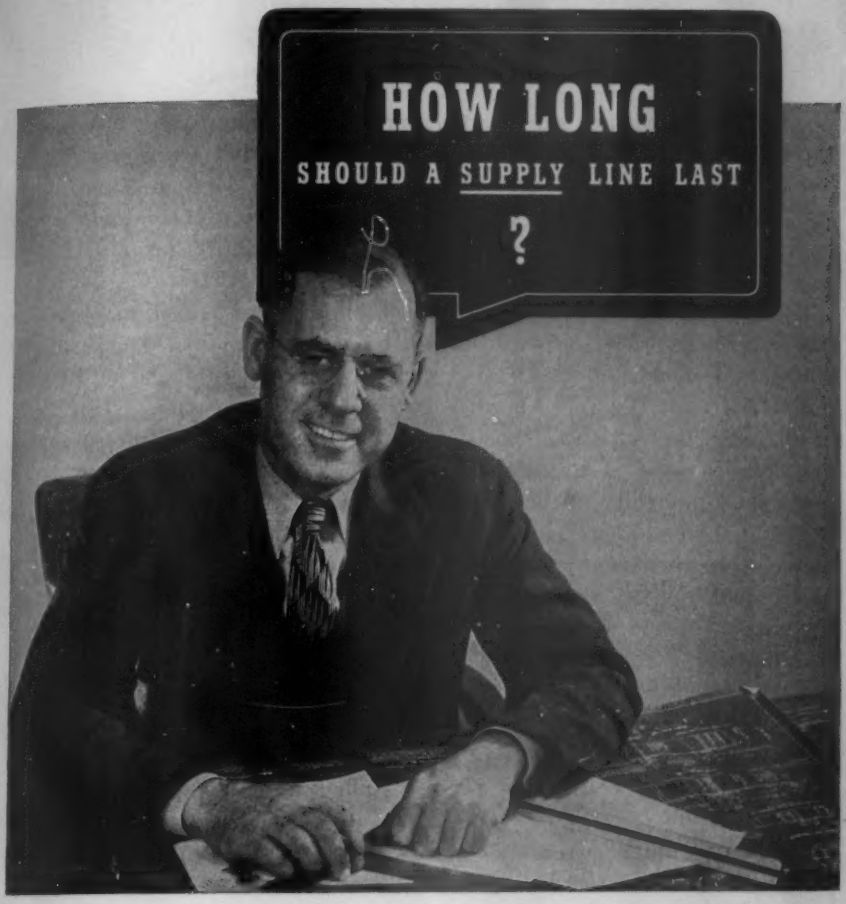
DAWES SILICA MINING COMPANY
Silica Mines
THOMASVILLE, GEORGIA

EDSON
DIAPHRAGM PUMPS

Hand Operated—size 2″, 2½″, 3″, 4″
Power Operated—size 3″ and 4″
Open Discharge or Force Pump
Skid, Truck or Trailer Mounted

Complete Pump Outfits, Genuine Edson Pumps, Suction Hose, Brass Couplings, Bronze Clamps, Red Seal Diaphragms, Brass Strainer or Foot Valve, Hose Spanners, Adapters, Etc. Standard Hydrant Protector, Brass Hydrant Pump.

THE EDSON CORPORATION
Main Office and Works: 49 D St., South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn



• It's all very well to talk about water *distribution* mains lasting 100 years. BUT... as past experience has proved, the problem in designing *supply* lines is entirely different.

With *supply* lines, it's more often a question of balancing costs against obsolescence. Wells go dry . . . other sources of water become inadequate . . . and above all, growing cities ultimately require *supply* lines of larger diameter than can be anticipated at the time of the original purchase.

Realizing these facts, more and more waterworks engineers are designing their *supply* lines for local service requirements. And logically, many are turning to Armco Spiral Welded Pipe because it assures the greatest reliability and efficiency at the lowest cost per year. The American Rolling Mill Co., Pipe Sales Division, 905 Curtis St., Middletown, Ohio.

ARMCO ARMCO **SPIRAL WELDED PIPE**

(Continued from page 10)

What has been asked about meter readers may also be asked about filter operators, engine men, laboratory men and other categories of water works employees. Mentally mark out the word "foreman" and put in some job title in your department. Then think of the qualities the employee in such a position must have. Does it not give promise of value to you?

The "drifting" technic of personnel management has no more present day validity in the water plant than in the industrial plant. Departmental efficiency depends upon selection of men with definite relation of their individual aptitudes for the work to be done. Promotion, when made, needs to be made upon the basis of intelligent appraisal and not prejudice and idiosyncrasy. Why not do some rating in your department?

Just a moment, please! If the adoption of these suggestions is going to result in some more paper work and filing, forget it. If it is going to help you to rearrange your prejudices, forget it. But, if you feel sure it can be developed to the interest of your employees and your department, try it out. Above all, if you are already doing something of the sort, tell us about it.

A hardness testing instrument has been developed by one of the larger railroad systems, which makes it possible to produce data in the field even though the item tested has been installed in a structure or unit of equipment.

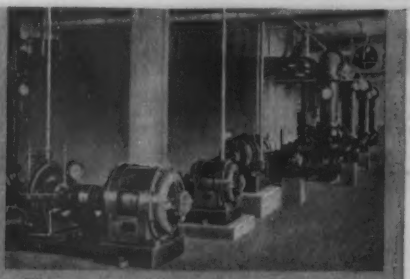
The instrument assembly consists of a very small anvil, a test bar of known hardness, a steel ball and a hammer. To make a test, the instrument is held against the specimen and the anvil is struck a sharp blow with the hammer. The impact is transmitted through the anvil to the bar, thence to the ball and through the ball to the specimen.

The force of the blow is said not to be a factor, the diameter of the impression in the test bar and in the specimen under test being relative to their hardness. The diameter of the impression made in the test bar and in the specimen is measured with a special microscope and the hardness of the specimen computed from data furnished with the equipment.

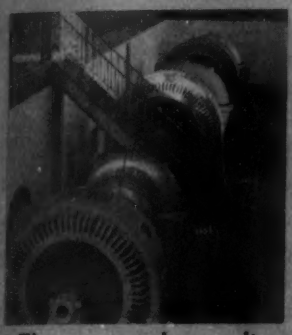
Iron body globe and angle valves designed to withstand exceptionally severe service are being offered by Crane Co. The plug type disc is made of Crane nickel alloy and the body seat ring of Exelloy, a specially heat treated chromium iron. This combination of metals for seating surfaces has been found by tests to offer excellent resistance to wear, temperature,

(Continued on page 18)

Water Works plant containing seven De Laval motor driven pumps; total capacity 7700 g.p.m.



Five motor driven pumps, ranging from 700 to 2700 g.p.m., which saved $11,053.39 in two years, as compared with older pumps.



Three pumping units which, including motors, tested over-all efficiencies of 86.14 to 88.0 per cent.

A 25 m.g.d. motor driven pumping unit which, after six years' service, tested 83.9 per cent wire to water efficiency.

De Laval Pumps with Motor Drive

save power and increase power factor

THE power limiting characteristic of the De Laval centrifugal pump protects the motor against overloading in the event of reduction of head pumped against.

The size of motor can be selected for highest efficiency under average load; an over-size motor is not necessary.

The low starting torque and the power-limiting characteristics of De Laval pumps both favor high power factor, and hence saving in line, transformer and generator losses and in generator capacity, and improve voltage regulation.

De Laval pumps are ideally suited to self-starting synchronous motors, which may be used to correct low power factor caused by other machines.

De Laval pumps show high efficiency initially and the De Laval LABYRINTH WEARING RINGS maintain this efficiency.

Ask for Leaflet E-1166.

DE LAVAL STEAM TURBINE CO., TRENTON, N. J.

4089

Trade Mark MABBS Reg. U. S. Pat. Off.

PREVENT WEAR AND CUTTING of rods, plungers and shafts by using

MABBS RAWHIDE PACKING

on your Water Works and Sewage pumps and valves. Practically antifrictional, it saves enough in POWER to pay for itself in a short time. For over 45 years Mabbs Rawhide Packing has proven its superiority over other packings for these purposes.

Why not use it in your plant and benefit thereby?

MABBS HYDRAULIC PACKING COMPANY, *Inc. 1892*, 431 S. Dearborn St., Chicago, Ill.

(*Continued from page 12*)

galling and scoring. In addition, these metals are harder, stronger and tougher than metals ordinarily used in iron valves. These valves are recommended for 150-pounds steam working pressure and 300-pounds on cold water, oil or gas lines. They are made in sizes $\frac{1}{4}$ to 3-inch, and also are recommended for throttling service. Interchangeability of parts is a feature. The stuffing boxes are fitted with a gland and filled with high grade packing and may be repacked while under pressure when wide open. These improved iron body valves are identified as 314-$\frac{1}{2}$-P globe and 316-$\frac{1}{2}$-P angle.

At the 1937 Central States Section meeting, there was an inspection made of the Ford Motor Company plant and its water supply facilities. The water works men found a point of great interest when they discovered a well-equipped truck for distribution system control work. Among other things, the truck contained one of the Homelite gasoline-driven generator sets. This was available not only as an emergency light source, but also as a source of power for a portable power-driven wrench. This wrench was a combination of a standard electric drill with a system of gears so arranged that it could be used to operate large gate valves. The combination is also reported as being useful to operate pipe threading dies, pipe taps, winches, etc., when a power output of 100–400 foot-pounds is sufficient for the purpose needed.

The U. S. Pipe & Foundry Company has announced certain personnel changes, effective the first of the year, which interest Association members. H. A. Hoffer will be transferred to Burlington, N. J., as Assistant General Sales Manager. Lloyd Nelson, who has been active in the affairs of the Central States Section as its efficient Secretary, moves to Philadelphia as Eastern Sales Manager. S. E. Linderman, who has been in charge of the company's Washington office, will go to Pittsburgh as Sales Agent in the territory formerly handled by Nelson.

(*Continued on page 20*)

Before experimenting with any materials for underground mains—

CHECK THEM AGAINST THESE TEN POINTS OF PROTECTION

☐ ***Long Life:*** Has it long life? How long? In evaluating bids, cast iron pipe is universally figured at 100 years minimum.

☐ ***Internal Pressure:*** An average of many internal hydrostatic pressure tests on standard six-inch Class B cast iron pipe shows this pipe withstands more than 2100 pounds pressure per square inch. Another material failed at 290 pounds pressure per square inch.

☐ ***Tensile Strength:*** Routine specimens cut from standard Class B cast iron pipe show tensile strength ranging from 23,000 to 25,000 pounds per square inch. Another material shows a tensile strength of less than 2,000 pounds per square inch.

☐ ***Toughness:*** Under hydrostatic pressure and the impact of a 50 lb. hammer, ordinary cast iron pipe does not crack until the hammer is dropped four feet (beginning at one-foot with one-foot increases). Another material fails at one foot (beginning at three-inches with three-inch increases).

☐ ***Beam Load:*** Under beam stress tests, standard six-inch Class B cast iron pipe bears up under a load of 25,100 pounds and deflects approximately one-inch before breaking. Another material fails at 3760 pounds and deflects one-half inch.

☐ ***External Pressure:*** In regulation compression tests on a 12-inch section, standard six-inch Class B cast iron pipe withstands a crushing weight of 17,900 pounds. Another material fails at less than 4500 pounds.

☐ ***Imperviousness:*** The walls of cast iron pipe are impervious to leakage, seepage or sweating of water, gas or chemicals under internal hydrostatic pressure tests. Certain other materials are *not* impervious under similar tests.

☐ ***Tight Joints:*** For ordinary pressures, cast iron bell-and-spigot pipe—for high pressures, cast iron mechanical joint pipe—have stood the test of time and are known to be leak-proof. Certain other materials require joints yet to be proved.

☐ ***Tapping:*** Cast iron pipe taps cleanly with strong, tough threads, and loses little in structural strength. No other material withstands tapping as well.

☐ ***Flow Capacity:*** Under normal conditions, the flow capacity of cast iron pipe remains practically unimpaired for centuries. For the limited areas where active water is encountered, cement-lined or enamel-lined cast iron pipe is available. Under such conditions, no other material offers the combined long life and sustained flow capacity of lined cast iron pipe.

NOTE . . . ***Check each point only if you know the material in question meets the requirements with adequate margin of safety. If in doubt, find out before installing.***

Some materials meet some and others meet others but only

CAST IRON PIPE

meets them all

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago

(Continued from page 18)

The Lead Industries Association has made public and available for general use by water works engineers, a specification for calking lead. It reads: "Lead for calking purposes shall contain not less than 99.73 percent pure lead. Impurities shall not exceed the following limits: Arsenic, Antimony and Tin together, 0.015 percent; Cooper, 0.08 percent; Zinc, 0.002 percent; Iron, 0.002 percent; Bismuth, 0.25 percent; Silver, 0.02 percent. The producer's name or identification mark shall be clearly cast or stamped upon each piece of lead for calking purposes or, in the case of lead wool or other forms that can not be so marked, shall appear upon the label or package." The Association points out that calking lead must have a certain flexibility and durability in order to make it useful and long lived. The limits of impurities set out in the specification are such, in the opinion of the lead industry, as will assure the user that he will have available the proper type of material.

The Maryland State Planning Commission has just published a report on regional planning for the Annapolis-Baltimore-Washington area which

(Continued on page 22)

Warren Foundry & Pipe Corp.

ALSO

Warren Pipe Co. of Mass., Inc.

SALES OFFICES

11 BROADWAY, NEW YORK
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Manufacturers of

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Sizes 2" to 84"

Flanged Pipe *Flexible Joint Pipe*

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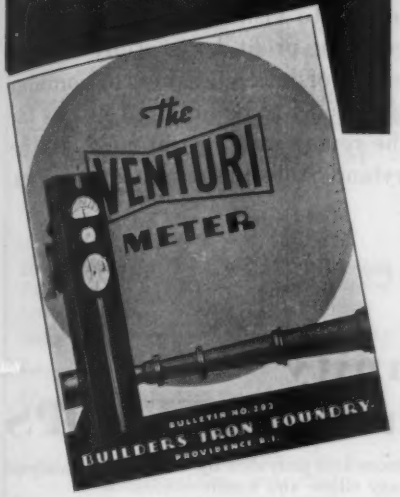
Special Castings *Short Body B. & S. Specials*

Warren (WF) Spun Centrifugally Cast Iron Pipe

WORKS: PHILLIPSBURG, N. J. and EVERETT, MASS.

Large Stock Enables Us to Make Prompt Shipments

Bulletin 293 NOW READY



WATER WORKS Designers and Superintendents will be interested in Bulletin 293, which contains up-to-the-minute information regarding Venturi Meters.

Of especial interest:

The illustrations and descriptions of the *new* Type M Register-Indicator-Recorders (Model D and Model F).

The discussion of the Chronoflo Meter as used in summing up the total flow of many different instruments.

BUILDERS IRON FOUNDRY
"Builders of Venturi Since 1891"
9 CODDING ST., PROVIDENCE, R. I.

BORN 35 YEARS TOO SOON

MOST of the next generation will be unable to boast of the pump handle as a muscle builder. Modern water purification plants, in charge of competent chemists and engineers, are fast replacing outmoded and often dangerous water supplies of past generations.

Health authorities everywhere have long since recognized the tremendous importance of water chlorination as a means of wide-spread elimination of diseases. But state and municipal water-works plants must be assured of *quick* and *adequate* supplies of Liquid Chlorine—and advice and technical assistance when they need it! Solvay's "Big 3" Service is a service system upon which water-works men can always depend.

Solvay Liquid Chlorine shipments are now routed from Syracuse, New York, and Hopewell, Virginia. Upon announcement early in 1938, shipments will also be made from Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited.

SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET NEW YORK

SOLVAY
LIQUID CHLORINE

(*Continued from page 20*)

comes closer to being of real value to the urban planners and to water works men than much of the material which has been produced in recent years. Documents telling the story of one or another Federal activity have been issued in such a flood and so often of a repetitious nature that those who receive them have almost given up trying to find out just what some of them actually contain. This document, however, is a pleasing compound of guidebook and land planners ideas, and includes sections on transportation and utility development. Recommendations are made for promotion of citizen support, legislation and coördination of future planning activities.

Members of this Association, who wish to visualize development of their community and its water services, can profit by a study of this document. It is a good example of collection of data related to the community environment and may well serve as a model to be imitated just as far as the conditions permit. Copies of the report may be obtained, at the price of forty cents each, from the Maryland State Planning Commission, Johns Hopkins University, Baltimore.

(*Continued on page 26*)

Why your community should have SAFETOPS

MINIMUM pressure loss provided by extra large standpipe and smooth easy elbow and nozzle curves.

Maximum reliability assured by simple, straight-line operating mechanism and special long-wearing valve and gasket materials.

Minimum repair expense secured by the unique Safety Breakable Section. When struck by an impact which *no* hydrant could resist, this section parts cleanly, protecting the major and expensive portions of the hydrant from damage. The hydrant can be returned to service by one man, within half an hour, without excavating or shutting off the water pressure, and with parts costing only $6.00.

Maximum convenience obtained by ease of adjustment of working parts, nozzle positions, lubrication, etc.

Write for descriptive bulletin

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SAFETOP
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Analysis of the water supplies for municipalities, industrial plants, private estates and camps. Swiming pool control.

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Help Build up Your Association by Bringing in a New Member

SEND FOR
APPLICATION BLANKS

AMERICAN WATER WORKS ASSOCIATION
29 W. 39th St.
NEW YORK CITY

(*Continued from page 22*)

The Permutit Company has developed a new "Dustproof" dry chemical feeder which is housed in a cabinet so as to hold to a minimum the dust nuisance frequently associated with the handling of certain light materials. Its maximum feed rate varies from 100 pounds per hour for active carbon to 450 pounds per hour for aluminum sulfate. The minimum accurate rate is indicated 2½ percent of the maximum.

A new periodical "Current Titles" has just appeared, listing the text contents of the principal engineering journals of the world. Over 125 journals are included in the first issue and more than 60 others will be added. Each publication included is shown in the form of its contents page. The Journal of the American Water Works Association, for example, is listed by the table of contents of its September number. The new publication gives promise of having great value to those who have an interest in knowing what is being published and who are unable to take the time to study all the magazines. The annual subscription rate for "Current Titles" is $3.00. A trial four-issue subscription may be obtained by sending $1.00 to "Current Titles," 928 Broadway, New York.

(*Continued on page 28*)

Job Finished
days sooner

When you use Tegul-MINERALEAD in Bell and Spigot Main jointing, your pipe lines should meet a reasonable leakage specification at once. • Trenches can be closed and streets restored to normal without delay. • Tegul-MINERALEAD is a sulphur base compound with all the advantages which have won high favor for MINERALEAD—ingot form; convenient to transport, store and handle; impervious to snow, rain and flood; composition cannot change in transit; needs no skilled labor; no caulking nor deep bell holes.

A Tegul PRODUCT

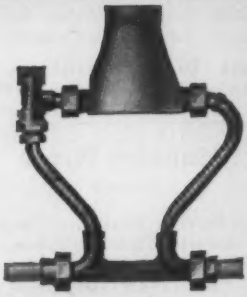
For booklet, address the ATLAS MINERAL Products Company of Pennsylvania. Mertztown, Pennsylvania

Tegul-MINERALEAD

Improved Jointing Compound for Bell & Spigot Water Pipe

The ATLAS MINERAL PRODUCTS CO., *of Pennsylvania*
Mertztown • Pennsylvania

The Coppersetter
. A COMPLETE METER MOUNTING



The COPPERSETTER is a simple, convenient and durable fitting for installing water meters in horizontal service lines. It is all brass and copper, made in several heights and can be provided with an inverted ground-key angle valve at the meter inlet. Write for more information about the COPPERSETTER.

The Ford Meter Box Co.
WABASH, INDIANA

THE SIMPLEX COUPLING

Another reason why Transite Pipe is the Economical Water Carrier

Easily assembled, flexible, bottle-tight, SIMPLEX COUPLINGS lower installation and maintenance expense, help keep pressure high and pumping costs permanently low . . .

THE Simplex Coupling used on Transite Pipe saves money during installation and helps greatly to keep maintenance and pumping expense permanently low.

No caulking with Simplex Couplings. Hence rapid assembly by unskilled labor. No large bell holes either; trenching costs are less.

Furthermore, Transite's flexible Simplex joints are permanently bottle-tight. They prevent the breaks in mains, the heavy maintenance expense, so often caused by leaks washing away supporting soil.

And by also preventing a multitude of lesser leaks, Simplex joints help maintain constant pressure and eliminate the costly pumping of water that, through leakage, never reaches the consumer.

And as for Transite, the pipe . . . It is built for permanence. It is designed to end corrosion troubles, inside, outside, clear through. Transite means lower installation costs, lower maintenance costs, lower pumping costs. In every respect, Transite Pipe is the economical water carrier.

For full details, address Johns-Manville, 22 E. 40th St., New York, N. Y.

UNSKILLED LABOR equipped with a special jack-type puller assembles Simplex Couplings with notable speed and economy. Note the narrow trench; the absence of the customary large bell holes.

Johns-Manville
TRANSITE PRESSURE PIPE
An Asbestos Product

(*Continued from page 26*)

Brass fittings for flared copper tubing, discontinued a few years ago, have been reinstated as a regular line of Crane Co. products. These fittings include elbows (90 and 45 degree), tees, couplings, reducers, adapters and flanging tools, in sizes $\frac{3}{8}$ to $1\frac{1}{4}$-inch. Cast parts of these fittings are made in steam brass, while all compression nuts are forged brass, and the flanging tool is made of steel. These fittings are rated at 175 pounds water working pressure.

As a water works man, are you not asked questions about swimming pools and methods of purifying the pool water? If so, you will find useful a booklet recently published by the Graver Tank and Mfg. Co., of East Chicago, Indiana. It is called "Pure as the Water You Drink" and contains a great deal of information about construction and operation of swimming pools in a form that will help to answer many questions. Naturally, the Graver Co. points out the good qualities of the equipment it manufactures.

(*Continued on page 30*)

CLEAN YOUR WATER MAINS

One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal—and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

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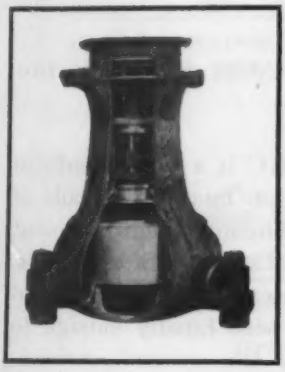
NO OBSOLESCENCE

CAPITAL VALUE UNIMPAIRED

THE SYMBOL OF SUSTAINED ACCURACY

THE life and the service of Trident and Lambert Water Meters are protected by the fact that NEW Interchangeable Parts make OLD Trident and Lamberts NEW. Yet this is only one advantage of these Quality meters. A type for every service. Over 6 million made and sold the world over. Neptune Meter Company (Thomson Meter Corp.), 50 West 50th Street, (Rockefeller Center), New York City. Neptune Meters, Ltd., 345 Sorauren Avenue, Toronto, Ontario, Canada.



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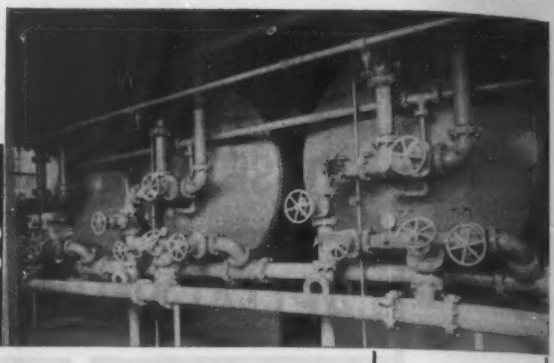
and LAMBERT WATER METERS

THE WORLD HAS BOUGHT OVER 6 MILLION

GENERAL STEEL PLATE CONSTRUCTION
GRAVER TANKS
WATER CONDITIONING EQUIPMENT



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For three-quarters of a century, the Graver Organization has been designing, constructing, and erecting tanks and water treating equipment for municipalities and for industry.

Whatever your requirements, Graver can serve you most efficiently.

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SETTLERS
FILTERS FOR MINERAL, TASTE, COLOR, ODOR REMOVAL
LIME AND SODA SOFTENERS
ZEOLITE SOFTENERS
IRON REMOVAL PLANTS
STERILIZERS

(*Continued from page 28*)

A Warsaw (Poland) newspaper thus tabulated "real wages" of labor in three countries:

United States: For two days' work, a shirt, a pair of shoes and a hat; fifty days' work, a car; 500 days' work, a small home with a garden.

Poland: Two days' work, one shoe; fifty days' work, a bicycle; 500 days' work, a tarred-roof wooden cottage.

Russia: Two days' work, a pair of bark shoes; fifty days' work, two buggy wheels; 500 days' work, a mud cabin.

Explosion-Proof Motors. Bulletin GEA-1341C is a 4-page bulletin describing a new line of explosion-proof induction motors. Details of construction are shown by a series of pictures. The manufacturers point out that these motors are characterized by unusual strength of the enclosing structure, by a design which prevents the escape of hot flame, and third, the ability of the structure to dissipate heat rapidly enough to prevent ignition of surrounding atmosphere by the external surfaces. General Electric Co., Schenectady, N. Y.

(*Continued on page 32*)

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for more than
50 YEARS

WATER WORKS SPECIALTIES

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Automatic Pressure Control Valves

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Surge-Relief and Combination Valves

Portable Fire Hydrants

Hydraulic Booster Pumps

ROSS VALVE MFG. CO., INC. TROY, N. Y.

Well Strainers and Deep-Well Turbine Pumps

A reciprocal relation, the life and functioning of the one depending much on the other.

A. D. COOK, INC.
Lawrenceburg — Indiana

WELL SCREENS

To meet your problems in sand and gravel wells.

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SAVE 30% ON YOUR TRENCHING COSTS WITH A
GIANT PIPE PUSHER

10 DIFFERENT SIZES TO FILL EVERY NEED
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Oceans of Water

Index to the Proceedings, Journal and Other Publications of The American Water Works Association from the Founding of the Organization. 1881–1933

This book opens the door to an immense store of knowledge covering studies, problems and experiences of hundreds of water works superintendents, engineers, scientific specialists, etc., during the past fifty-three years.

It is well bound in buckram, with stiff covers, and contains 233 pages. The price is $1.50 per copy to members and $2.50 per copy to non-members, postpaid.

Order from AMERICAN WATER WORKS ASSOCIATION
29 W. 39th St., New York, N. Y.

(*Continued from page 30*)

Jacob Schwartz, Chairman of the Finance and Accounting Division, has been promoted to the position of Deputy Chief Engineer of the New Jersey State Public Utility Commission, with offices at Newark. He has formerly been engineer in charge of the service inspection division.

The construction industry needs statistics! Such was the opinion of the open meeting of the Construction Industry, held in Washington, D. C., November 18th under the sponsorship of the Construction League of the United States. For the first time there was brought sharply into focus the need for and importance of adequate and accurate statistics relating to the construction and manufacturing industries and the planning of Federal, State and Municipal public works' programs.

(*Continued on page 38*)

WHERE NATURAL GAS IS AVAILABLE

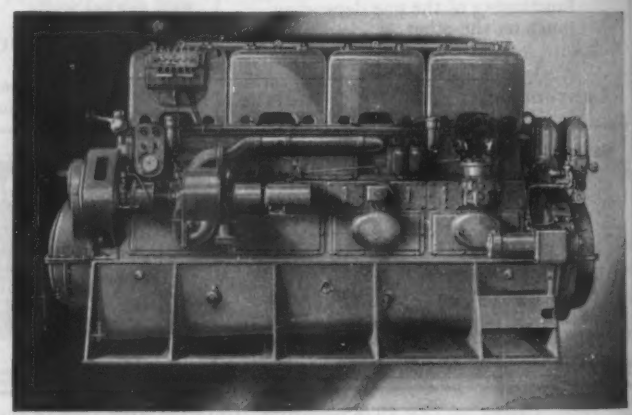
POWER CAN BE DEVELOPED ON LOW PRICED FUEL UNDER 3 MILLS PER K.W.H. FUEL COST

STERLING HIGH DUTY

Sterling

INTERNAL COMBUSTION ENGINES

Gas - Gasoline Oil Engines



8-Cylinder Sterling Gas Engine, Bore 8", Stroke 9", dual overhead valves, removable cylinder sleeves, counterweighted crankshaft.

Scientifically built 900 R.P.M. engines, utilizing modern metallurgy, have been proven in service. Repeat orders for 21 – 400 H.P. engines from one client in 1937! Outstanding mechanical developments at a low price, warrant your investigation.

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A Branch Connection While the Water Flows

QUICKLY, easily, safely, a 30" branch connection can be cut into a 30" or larger main by the use of a Smith Tapping Machine while the water in the main flows merrily along under its usual full head of pressure.

Shut-downs are avoided. They are unnecessary. Expense is saved. Danger is avoided. Health is protected.

This machine is power-operated. It uses an air-motor which supplies a smooth, steady flow of power which enables it to cut through the hardest main in less than an hour.

Other sizes of Smith Tapping Machines will make branch connections from 2" to 42" into any size mains not smaller in diameter than the connection desired.

Smith Tapping Machines are standard equipment today in the water and gas fields.

Send for full details

SMITH TAPPING MACHINES

The A. P. Smith Manufacturing Company

East Orange, New Jersey

Smith Tapping Machines—Tapping Sleeves and Valves—O'Brien Hydrants—Valve-Inserting Machines—Removable Plugs, Pipe Cutting Machines—Corporation Tapping Machines—Gas Tee-Inserting Machines—Corporation Cocks—Federal Water Meters.

THE A. P. SMITH MFG. CO. EAST ORANGE, N. J.

(*Continued from page 32*)

The Los Angeles Department of Water and Power lost on October 30th, as the department's publication said, "the best friend it ever had" when Dr. John R. Haynes died after a month's illness. His service to his city began in 1903 when he was a member of the board which drew up the city charter. He was appointed to the Board of Water and Power Commissioners in 1921 and served thereon continuously until his death.

He was one of those remarkable men, so vital to the future of American urban life, who are able to render constant broad-minded and disinterested service to a community. Early in his relation to the board, he grew to realize how necessary to the growth and prosperity of the Los Angeles metropolitan areas was an adequate water supply. Consequently, he did yeoman work in support of the Owens river project and followed through in all activities to a support of the Colorado river project.

His death was not alone a loss to the department nor to the city he so loyally served. The example of his high-minded service has been an inspiration to forward-looking people in the municipal field the country over. It is firmly to be hoped that the reorganization of the Los Angeles Water and Power Board will be made in such manner as to maintain the high standards set by Dr. Haynes.

Philip Carlin, for forty-six years Superintendent of the Sioux, City, Iowa, Water Works, and a member of this association for the same number of years, died after a brief illness on November tenth.

He was a familiar figure at the meetings of the Missouri Valley Section as well as the Association's General Convention. His loyalty to and interest in the organization had remained untouched by the years. The cities of this land need such men to direct their water service, to protect their citizens against ill health and their homes against conflagration.

58TH ANNUAL CONVENTION, NEW ORLEANS, APRIL 24-28, 1938

DEC 27 1937

JOURNAL
OF THE
AMERICAN WATER WORKS ASSOCIATION

VOL. 29, NO. 12 DECEMBER, 1937

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Abstracts—News of the Field

Published Monthly
by the
AMERICAN WATER WORKS ASSOCIATION
29 WEST 39TH STREET, NEW YORK

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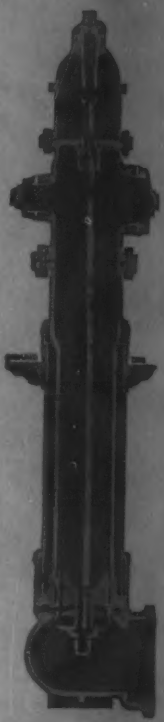
"Let it Snow. WHEN WE INSTALLED MATHEWS HYDRANTS WE BURIED OUR TROUBLES FOREVER"

Maintenance men laugh at winter — after they get Mathews Hydrants.

NO FREEZING. There's nothing that will freeze about this hydrant. Its operating threads are protected from above and below. Its barrel is emptied immediately after use by a positive and automatic drain valve. The entire hydrant is dry except when in use.

NO HEAVING. Deep frosts put a terrific strain on most hydrants. The swelling force of frozen ground pulls the hydrant away from its main, cracking castings or starting joints. But not Mathews. It is the one hydrant surrounded by a loose protection case. Frost can't heave any water-carrying part.

NO DIGGING. Plant a Mathews Hydrant, and you'll never dig it up. If a truck smashes it, you just unscrew the broken barrel and replace it from above. The same for overhauls, modernizing or grade changing. Specify Mathews. It will pay you well.



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R. D. WOOD CO.
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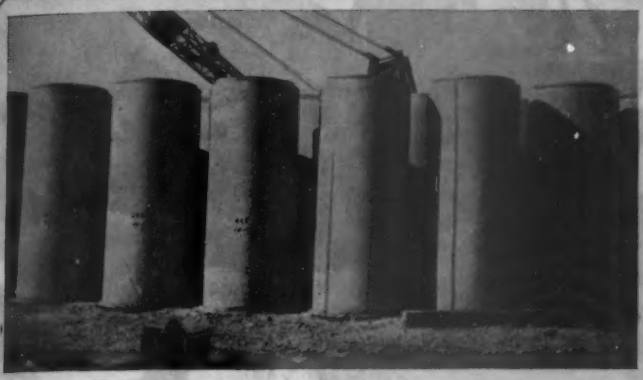
manufacturers of SAND-SPUN PIPE which is centrifugally cast in sand molds, and R. D. Wood heavy-duty gate valves for water works.

PUBLISHED MONTHLY AT MT. ROYAL AND GUILFORD AVENUES, BALTIMORE, MD.
Entered as second class matter April 10, 1914 at the Post Office at Baltimore, Md., under the Act of August 24, 1912. Accepted for mailing at a special rate of postage provided for in section 1103, Act of October 3, 1917; authorized August 6, 1918

Made in United States of America



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20,600 feet of 48″ pipe

FOR their new plant at Charleston, South Carolina, the West Virginia Pulp & Paper Company selected Lock Joint Reinforced Concrete Pressure Pipe for the 48″ water supply main and Lock Joint Concrete Drain Pipe for the 36″ waste water line.

In a highly competitive field such as the paper industry, where efficient management and economy of operation are paramount to success, Lock Joint Concrete Pipe offers greater opportunities for profitable operations through the immediate and ultimate economies of—

Low First Cost
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Long Life—Low Depreciation Charges
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No Exposed Metal to Rust and Discolor Water

Lock Joint Concrete Pipe is the only Pipe which embraces all of these essential attributes.

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LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

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THIS MONTH marks the end of another year's service for many millions of lengths of cast iron pipe installed throughout America, some of which have rounded out or passed the century mark in useful life. In six large cities are more than six million lengths of cast iron pipe comprising 95 per cent of an aggregate of 13,000 miles of water distribution mains. Experience with cast iron pipe—in water, gas and sewerage service—is ample and conclusive as to the *strengths to meet stresses* and the *corrosion-resistance* that add up to a long, economical life. Cast iron pipe is not only a *proved* but a constantly-*improved* product. U. S. Super-de Lavaud Pipe, centrifugally cast in a metal mold without chill, is a notable example.

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COMING MEETINGS

April 24-28, 1938*—Annual Convention of American Water Works Association, at Hotel Roosevelt, New Orleans, Louisiana. Secretary, H. E. Jordan, 29 West 39th St., New York, N. Y.

December 29—Joint Meeting New York Section and New Jersey Section at Hotel New Yorker, New York, N. Y. Secretary N. Y. Sect., R. K. Blanchard, 50 West 50th St., New York, N. Y. Secretary N. J. Sect., H. N. Lendall, Rutgers University, New Brunswick, N. J.

March 17-18—New York Section, at Hotel Jamestown, Jamestown, N. Y. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

March 21-23—Kentucky-Tennessee Section, at Louisville, Ky. Secretary, H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

March 23-25—Canadian Section, at Prince Edward Hotel, Windsor, Ontario. Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

April 5-6—Illinois Section. Place to be announced. Secretary W. D. Gerber, P. O. Box 232, Urbana, Ill.

April 7-8—Indiana Section, at Purdue Union Building, West Lafayette, Indiana. Secretary, J. A. Bruhn, Box 855, Indianapolis, Ind.

May 13-14—Montana Section at Bozeman, Montana. Secretary, H. B. Foote, State Board of Health, Helena, Mont.

May 19-21—Pacific Northwest Section, at Spokane, Washington. Secretary, Fred Merryfield, Oregon State College, Corvallis, Ore.

May 23-25—Florida Section, at Daytona Beach, Florida. Secretary, J. R. Hoy, 404 Hildebrandt Bldg., Jacksonville, Fla.

October 6-7—Four States Section, at Washington, D. C. Secretary, Carl A. Hechmer, Washington Suburban Sanitary District, Hyattsville, Md.

October 17-20—Southwest Section, at Hotel Biltmore, Oklahoma City, Okla. Secretary, L. A. Quigley, Supt., City Water Works, Fort Worth, Texas.

October 26-29—California Section, at Riverside, Calif. Secretary, Carl M. Hoskinson, Div. of Water, Sacramento, Calif.

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*See page 36 (advertising section) for hotel rates. See map of downtown New Orleans on page 30 (advertising section) of the November Journal.

CHANGES IN MEMBERSHIP

October 1 to 31, 1937

New Members

ABRAMS, M. F. Wailes Dove-Hermiston Corp., 17 Battery Place, New York, N. Y.

ALEXANDER, LOUIS J. Southern California Water Co., 950 Bendix Building, 12th & Maple Streets, Los Angeles, Calif.

ANDREWS, A. I. Sales Engineer, Wallace & Tiernan Co., 416 Flour Exchange Bldg., Minneapolis, Minn.

TOWN OF BLOOMFIELD, Jos. W. Obreiter, Town Engr., Bloomfield, N. J. (Corp. Member.)

BUNKER, F. L. Sales Engineer, P.O. Box 1122, Charlotte, N. C.

BURGESS, JOHN. Office Engineer, Board of Water Commissioners, Box 629, Denver, Colo.

CITY OF CASPAR, J. F. Cowen, Mayor, City Hall, Caspar, Wyo. (Corp. Member.)

CHAPTON, HERBERT J. Los Angeles Dept. of Water & Power, Box F, West Portal, Bishop, Calif.

CLAY, JOHN W. Supt. of Water Works, 1010 S. Second Street, Alhambra, Calif.

DARLING, K. E. Gen. Mgr., Southern Wyoming Utilities, Rock Springs, Wyo.

DIEMER, ROBERT B. Distribution Engr., Metropolitan Water District, 306 West 3rd Street, Los Angeles, Calif.

EICHBERG, E. Repr., The Glauber Brass Mfg. Co., 3215 W. Franklin Street, Richmond, Va.

GIBNEY, W. J. Sales Engineer, 454 Taunton Place, Buffalo, N. Y.

GIBSON, W. B. Chemist, Water Treatment Plant, Fort Myers, Fla.

WATER & SEWER DEPT., Town of Greenburgh, Westchester County, N. Y. (Corp. Member.)

HAISS, CARL E. J. San. Engr., State Office Bldg., 80 Center Street, Room 892, New York, N. Y.

HALL, GEORGE LAIRD. Ambassador Apts., Baltimore, Md.

HALL, JOHN D. Supt. of Water Dept., Drawer U, Waverly, N. Y.

CITY OF HEALDSBURG, Archer B. Stuart, Water Supt., City Hall, Healdsburg, Calif. (Corp. Member.)

HECK, ROBERT L. Supt., Municipal Filter Plant, Pittsburg, Calif.

HERRON, WILLIAM L. Sales Engr., National Meter Co., 4207 First Avenue, Brooklyn, N. Y.

HEWSON, FRANK. Truck Transportation, 6800 So. Alameda St., Los Angeles, Calif.

HURD, C. E. Supt. of Water, Box 47, Punta Gorda, Florida.

HURST, W. B. Supt., Water Works, Jacksonville, N. C.

JOHNSON, FRANCIS M. Sanitary Engineer, Box 154, Murphy, N. C.

JOHNSTON, W. E. Sales Repr., National Meter Co., Gainesville, Fla.

MANN, KARL. Water Works Engineering, 24 West 40th Street, New York, N. Y.

MARQUARDT, DR. ING. E. Prinzgenplaz 23/11, Munchen, Germany.

MCCLANE, J. HUSTON. Bureau of Engineering, State Board of Health, Jacksonville, Fla.

MINCUS, ALEXANDER J. Chemist, 315 Pearl Street, Hartford, Conn.

MONROE AVENUE WATER DISTRICT, 2010 Monroe Avenue, Rochester, N. Y. (Corp. Member.)

MORRILL, JOHN E. Asst. Engr., 526 Carondelet Street, New Orleans, La.

NANCE, E. L. Supt. of Plants, Route #3, Charlotte, N. C.

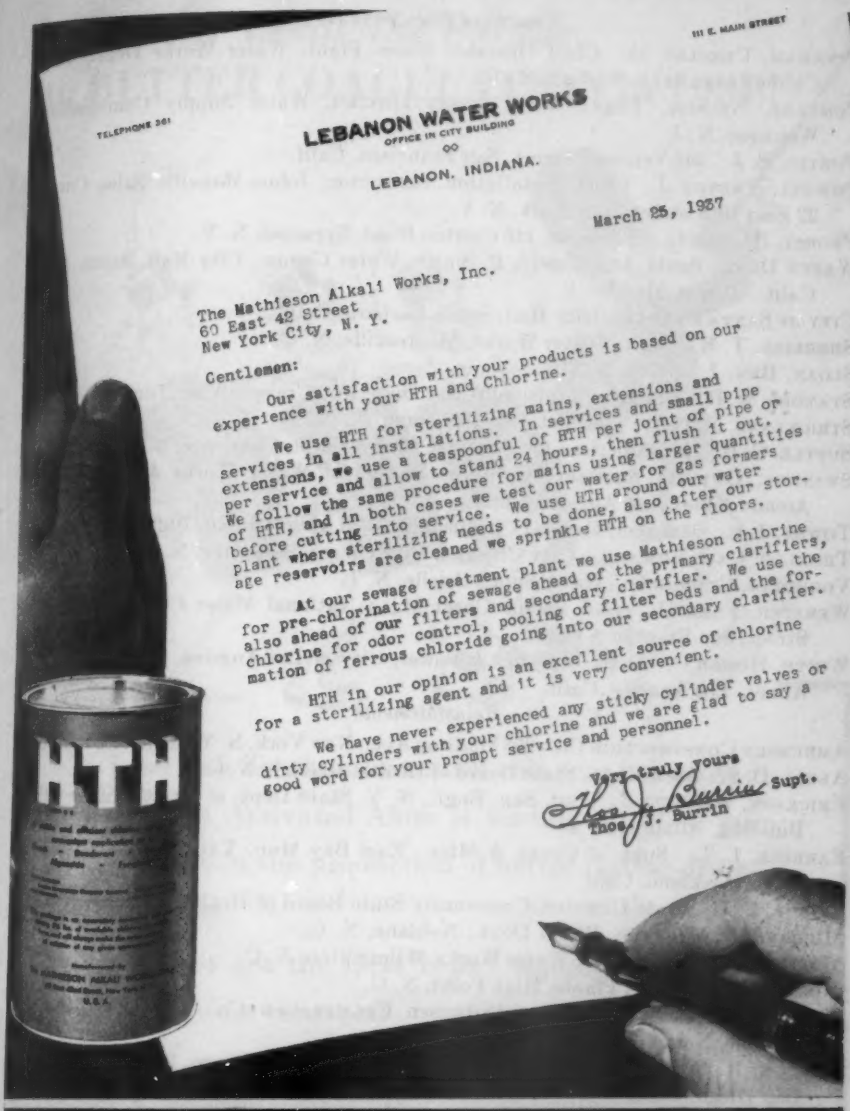
NEIGHBOUR, H. M. Supt. of Water & Sewers, City Hall, Santa Ana, Calif.

NESIN, BENJAMIN C. Chemist, Mt. Prospect Laboratory, 421 Flatbush Ave., Brooklyn, N. Y.

THE OHIO SALT CO., H. M. Olson, Promotional Engr., 171 Longue Vue Drive, Mt Lebanon, Pittsburgh, Pa. (Assoc. Member.)

PHELPS, ELLIS K. Sales Engr., 322 Fairmount Road, Ridgewood, N. J.

(*Continued on page 14*)



111 E. MAIN STREET

TELEPHONE 261

LEBANON WATER WORKS
OFFICE IN CITY BUILDING

LEBANON, INDIANA.

March 25, 1937

The Mathieson Alkali Works, Inc.
60 East 42 Street
New York City, N. Y.

Gentlemen:

Our satisfaction with your products is based on our experience with your HTH and Chlorine.

We use HTH for sterilizing mains, extensions and services in all installations. In services and small pipe extensions, we use a teaspoonful of HTH per joint of pipe or per service and allow to stand 24 hours, then flush it out. We follow the same procedure for mains using larger quantities of HTH, and in both cases we test our water for gas formers before cutting into service. We use HTH around our water plant where sterilizing needs to be done, also after our storage reservoirs are cleaned we sprinkle HTH on the floors.

At our sewage treatment plant we use Mathieson chlorine for pre-chlorination of sewage ahead of the primary clarifiers, also ahead of our filters and secondary clarifier. We use the chlorine for odor control, pooling of filter beds and the formation of ferrous chloride going into our secondary clarifier.

HTH in our opinion is an excellent source of chlorine for a sterilizing agent and it is very convenient.

We have never experienced any sticky cylinder valves or dirty cylinders with your chlorine and we are glad to say a good word for your prompt service and personnel.

Very truly yours
Thos. J. Burrin Supt.
Thos. J. Burrin

HTH

FROM LEBANON, INDIANA

COMES FURTHER EVIDENCE THAT WATER WORKS MEN APPRECIATE

HTH AND MATHIESON CHLORINE

(*Continued from page vi*)

PINKHAM, CHESLEY M. Chief Operator Filter Plant, Water Works Dept., 1312 Colina Lane, Santa Barbara, Calif.

POMFRET, NELSON. Engr., North Jersey District, Water Supply Commission, Wanaque, N. J.

PORTER, S. J. 345 Vermont Street, San Francisco, Calif.

POWELL, TREVOR J. Chief Installation Instructor, Johns-Manville Sales Corp., 22 East 40th Street, New York, N. Y.

PROBST, HAROLD G. Salesman, 115 Carlton Road, Syracuse, N. Y.

WATER DEPT., Santa Ana, Joseph P. Smith, Water Comm., City Hall, Santa Ana, Calif. (Corp. Member.)

CITY OF SANTA BARBARA, City Hall, Santa Barbara, Calif.

SHERRILL, T. R. Supt., Water Works, Mooresville, N. C.

SLOAN, BEN. J. Sylva, N. C.

STANGER, W. H. Manager Municipal Water Dist., 1610 Cravens Ave., Torrance, Calif.

STRICKLAND, JOHN F. Chemist, Box 282, Dunn, N. C.

SUTTLE, C. B., JR. American Cyanamid & Chem. Corp., Charlotte, N. C.

SWINNEY, GUY H. Sanitary Inspector, Bureau of Water Works & Supply, 240 Arcade Annex, Los Angeles, Calif.

TOWNS, J. E. Manager, General Chemical Co., 350 Abbott Road, Buffalo, N. Y.

TREXLER, CARL EDWARD. City Chemist, City Offices, Salisbury, N. C.

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WEBSTER, FRED D. Asst. Pacific Coast Mgr., National Meter Co., 1048 Folsom Street, San Francisco, Calif.

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STEWART, SPENCER W. Pres., Ambursen Construction Co., Inc., 295 Madison Avenue, New York, N. Y.

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TRICE, M. F. Asst. Engr., State Board of Health, Raleigh, N. C.

Deaths

BEARE, J. C. Supt., Water Dept., 70 North Street, Catskill, N. Y.

MACMULLEN, F. J. 106 N. Church Street, East Point, Ga.

MCKINNON, R. W. Chief Engr. of Reclaimation, Province of Manitoba, Winnipeg, Man., Canada.

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PETERSEN, P. A. Dist. Mgr., Neptune Meter Co., Atlanta, Ga.

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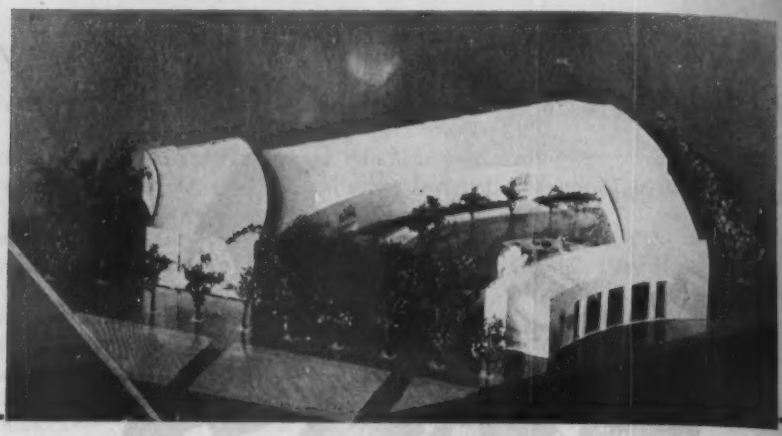

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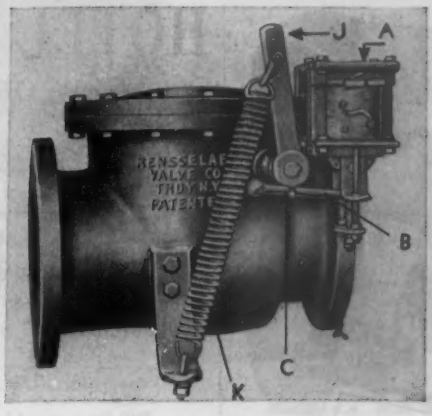

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Neptune Meter Co.
Pittsburgh Equitable Meter Co.
A. P. Smith Mfg. Co.
R. W. Sparling
Thomson Meter Corp.
Worthington-Gamon Meter Co.
Meters (Venturi Type):
Builders Iron Foundry
National Meter Co.
Meter Boxes:
Crane Co.
Ford Meter Box Co.
Mueller Co.
Pittsburgh Equitable Meter Co.
Meter Couplings:
Buffalo Meter Co.
Crane Co.
S. R. Dresser Mfg. Co.
Hersey Mfg. Co.
Mueller Co.
National Meter Co.
Pittsburgh Equitable Meter Co.
Thomson Meter Corp.
Worthington-Gamon Meter Co.
Meter Coupling Yokes:
Ford Meter Box Co.
Mueller Co.
Meter Reading and Record Books:
Buffalo Meter Co.

Meter Testers:
Buffalo Meter Co.
Ford Meter Box Co.
Hersey Mfg. Co.
Mueller Co.
National Meter Co.
Neptune Meter Co.
Pittsburgh Equitable Meter Co.
Meter Washers:
Mabbs Hydraulic Packing Co.
Mixing Kettles:
Alco Products, Inc.
Graver Tank & Mfg. Co., Inc.
Motors, Electric:
Allis-Chalmers Mfg. Co.
U. S. Electrical Motors, Inc.
Oil Engines:
Allis-Chalmers Mfg. Co.
Worthington Pump & Machinery Corp.
Packing, Rawhide:
Mabbs Hydraulic Packing Co.
Pavement Breakers:
Worthington Pump & Machinery Corp.
Penstocks, Steel:
Alco Products, Inc.
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Pipe, Asbestos-Cement:
Crane Co.
Johns-Manville Corp.
Pipe, Brass:
American Brass Co.
Crane Co.
A. P. Smith Mfg. Co.
Pipe, Cast Iron (and Fittings):
American Cast Iron Pipe Co.
Central Foundry Co.
Crane Co.
Lead Lined Iron Pipe Co.
United States Pipe & Foundry Co.
Warren Foundry & Pipe Corp.
R. D. Wood Co.
Pipe, Cement Lined:
American Cast Iron Pipe Co.
Central Foundry Co.
United States Pipe & Foundry Co.
Warren Foundry & Pipe Corp.
R. D. Wood Co.
Pipe Coatings and Linings:
(See Pipe, Cement Lined)
(See Bituminous Coatings and Linings)
Pipe, Concrete:
Lock Joint Pipe Co.
Pipe, Copper:
Crane Co.
Mueller Co.
Pipe Cutting Machines:
Crane Co.
A. P. Smith Mfg. Co.
Pipe Jointing Materials:
(See Jointing Materials)
Pipe Joints, Mechanical:
Crane Co.
S. R. Dresser Mfg. Co.
Pipe, Lead Lined (and Fittings):
Crane Co.
Lead Lined Iron Pipe Co.
Pipe, Pressure, Riveted and Welded:
Alco Products, Inc.
Chicago Bridge & Iron Company
Crane Co.
Pipe, Steel:
Alco Products, Inc.
Chicago Bridge & Iron Company
Crane Co.
Plugs:
A. P. Smith Mfg. Co.
Potentiometers:
Hellige, Inc.
Pressure Regulators:
Crane Co.
Golden-Anderson Valve Specialty Co.
Mueller Co.
Ross Valve Mfg. Co.
Provers, Water:
Pittsburgh Equitable Meter Co.
Pumps and Pumping Engines:
Allis-Chalmers Mfg. Co.
DeLaval Steam Turbine Co.
Ross Valve Mfg. Co.
Sterling Engine Co.
Worthington Pump & Machinery Corp.
Pumps, Attached to Steam Turbines:
A. D. Cook, Inc.
Pomona Pump Co.
Worthington Pump and Machinery Corporation
Pumps, Centrifugal:
Worthington Pump & Machinery Corp.
Pumps, Deep Well:
A. D. Cook, Inc.
Crane Co.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Pumps, Diaphragm:
Edson Corp.
Pumps, Hydrant:
Edson Co.
Pumps, Portable:
Homelite Corp.
Worthington Pump and Machinery Corporation

Pumps, Power:
A. D. Cook, Inc.
Edson Corp.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Pumps, Sump:
A. D. Cook, Inc.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Pumps, Turbine:
A. D. Cook, Inc.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Rate Controllers:
American Water Softener Co.
Builders Iron Foundry
Recorders, Gas Density, CO_2, NH_3, SO_2, etc.:
Permutit Co.
Recording Instruments:
Builders Iron Foundry
Permutit Co.
Reservoirs, Steel:
Chicago Bridge & Iron Comyany
Graver Tank & Mfg. Co., Inc.
Pittsburgh-Des Moines Steel Co.
Rock Drills:
Worthington Pump & Machinery Corp.
Sand, Filtration:
Dawes Silica Mining Co.
Permutit Co.
Service Clamps, Galvanized:
Mueller Co.
Shaft Linings:
Alco Products, Inc.
Shovels, Underground:
Allis-Chalmers Mfg. Co.
Sleeves:
Crane Co.
S. R. Dresser Mfg. Co.
Grinnell Co.
Sleeves and Valves, Tapping:
Crane Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
R. D. Wood Co.
Sleeves, Long, River, Split:
S. R. Dresser Mfg. Co.
Rensselaer Valve Co.
Soda Ash:
Mathieson Alkali Works (Inc.)
Solvay Sales Corp.
Softeners and Purifiers:
American Water Softener Co.
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Special Vessels:
Alco Products, Inc.
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Pomona Pump Co.
Worthington Pump & Machinery Corp.
Stacks:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Standpipes, Steel:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Pittsburgh-Des Moines Steel Co.
Steel Plate Construction:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Storage Tanks:
Alco Products, Inc.
Chicago Bridge & Iron Company
Crane Co.
Graver Tank & Mfg. Co., Inc.
Strainers, Suction:
Crane Co.
Edson Corp.
Sulphate of Alumina:
(See Activated Alum and Alum)
Sump Pumps:
A. D. Cook, Inc.
Crane Co.
Worthington Pump & Machinery Corp.
Swimming Pool Refiltration System:
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Tanks, Elevated Steel:
Chicago Bridge & Iron Company
Pittsburgh-Des Moines Steel Co.
Tanks, Mixing:
Alco Products, Inc.
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Tanks, Steel:
Chicago Bridge & Iron Company
Graver Tank & Mfg. Co., Inc.
Pittsburgh-Des Moines Steel Co.
Tapping Machines:
Mueller Co.
A. P. Smith Mfg. Co.
Tapping Sleeves:
(See Sleeves and Valves, Tapping)
Taste and Odor Removal Plants:
Graver Tank & Mfg. Co., Inc.
Industrial Chemical Sales Div.
Permutit Co.
Taste Removal:
Graver Tank & Mfg. Co., Inc.
Turbidimeters:
Hellige, Inc.
Turbine Pumps:
A. D. Cook, Inc.

Worthington Pump & Machinery Corp.
Turbines, Steam:
Allis-Chalmers Mfg. Co.
DeLaval Steam Turbine Co.
Worthington Pump and Machinery Corporation
Turbines, Water:
DeLaval Steam Turbine Co.
Valve Boxes:
Crane Co.
Ford Meter Box Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
R. D. Wood Co.
Valve Inserting Machines:
A. P. Smith Mfg. Co.
Valves, Altitude:
Golden-Anderson Valve Specialty Co.
Ross Valve Mfg. Co., Inc.
Valves, Check, Flap, Foot, Hose, Mud and Plug:
A. D. Cook, Inc.
Crane Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
Valves, Detector Check:
Grinnell Co.
Valves, Float:
Crane Co.
Golden-Anderson Valve Specialty Co.
Ludlow Valve Mfg. Co.
Ross Valve Mfg. Co., Inc.
Valves, Gate:
Crane Co.
S. R. Dresser Mfg. Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Mueller Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
United States Pipe & Foundry Co.
R. D. Wood Co.
Valves, Large Diameter:
Alco Products, Inc.
Crane Co.
Ludlow Valve Mfg. Co.
Rensselaer Valve Co.
A. P. Smith Mfg. Co.
Valves, Regulating:
Crane Co.
Golden-Anderson Valve Specialty Co.
Mueller Co.
Ross Valve Mfg. Co.
Valves, Relief (Temperature and Pressure):
Crane Co.
Kitson Co.
Mueller Co.
Valves, Swing Check:
Crane Co.
Golden-Anderson Valve Specialty Co.
Grinnell Co.
Kennedy Valve Mfg. Co.
Ludlow Valve Mfg. Co.
Rensselaer Valve Co.
Valves, Uniflow Check (for Double Check Service):
Grinnell Co.
Valves, Water Meter Protection:
Crane Co.
Kitson Co.
Water Softener (Hot Lime Soda):
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Water Softener (Zeolite):
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Zeolite Chemical Co.
Water Softening Plants:
American Water Softener Co.
Fuller & Everett
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Zeolite Chemical Co.
Water Supply Contractors:
A. D. Cook, Inc.
Water Testing Apparatus:
Hellige, Inc.
Water Treatment Plants:
American Water Softener Co.
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Zeolite Chemical Co.
Water Waste Detection:
Builders Iron Foundry
Pitometer Co.
Water Works Construction, General:
Pittsburgh-Des Moines Steel Co.
Well Drilling Contractors:
A. D. Cook, Inc.
Well Screens:
A. D. Cook, Inc.
Crane Co.
Edward E. Johnson, Inc.
Wrenches, Ratchet:
Crane Co.
S. R. Dresser Mfg. Co.
Zeolite (Water Softener):
Graver Tank & Mfg. Co., Inc.
Permutit Co.
Zeolite Chemical Co.
Zeolites (Natural and Synthetic Minerals):
Graver Tank & Mfg. Co., Inc.
Permutit Co.

Again PITTSBURGH METERS *are chosen!*

Some 5,000 persons will occupy the 1,622 apartments in the new PWA Housing Project in Williamsburg, Brooklyn, New York. The Williamsburg Houses cover twenty-four acres or twelve city blocks. It is the country's largest low-rent and slum-clearance project.

The water supply for this good-sized "town within a city", like that of thousands of other towns and cities both large and small, is measured by Pittsburgh Water Meters. They can be relied upon to give accurate measurement and long service.

PITTSBURGH WATER METERS

...and TOLEDO!

Specified workmen drawing up bells of Dresser Couplings on 48" I.D. water line at Toledo, Ohio. Average installation time for Dresser joints this size: 30 minutes (two bolters).

AND THESE CITIES TOO!

Among the many that have voiced their confidence in Dresser Couplings by actual use, are these cities:

Flint, Mich. — Sheridan, Wyo.
Hood River, Ore. — Trenton, N.J.
Palmyra, N.Y. — Washington, D.C.

...for this Ohio city had completed their new all-Dresser-coupled 48" I.D. water line between filtration plant and pumping station, the engineer in charge expressed satisfaction with the "simplicity and speed of making Dresser joints," and the fact that the line could be completely backfilled *before* testing—with perfect assurance of tightness.

FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

PERMANENT TIGHTNESS—proved for 50 years, on 150,000 miles of pipe.
FLEXIBILITY—normal pipe movements—present in every line—are absorbed.
SIMPLICITY—joint parts are "factory-made"; ordinary labor can install.
STRENGTH—predetermined; joints safely withstand any specified pressure.
TRUE ECONOMY—a truly lower joint cost throughout the life of the line.

Write for our General Catalog No. 36.

Cutaway view of Dresser Style 38 Coupling, showing working principle. Note that plain-end pipe is used. The resilient gaskets, flexing with the pipe, safely absorb pipe movements.

THE MODERN TREND IS TO DRESSER COUPLINGS

DRESSER MFG. COMPANY, BRADFORD, PA. • *In Canada:* Dresser Mfg. Company, Ltd., 80 Front St., W., Toronto, Ont.

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Jointed for . . . Permanence with LEADITE

Generally speaking, most Water Mains are buried beneath the Earth's surface, to be forgotten,—they are to a large extent, laid for permanency. Not only must the pipe itself be dependable and long lived,—but the joints also must be tight, flexible, and long lived,—else leaky joints are apt to cause the great expense of digging up well-paved streets, beautiful parks and estates, etc.

Thus the "jointing material" used for bell and spigot Water Mains MUST BE GOOD,—MUST BE DEPENDABLE,—and that is just why so many Engineers, Water Works Men and Contractors aim to PLAY ABSOLUTELY SAFE, by specifying and using LEADITE.

Time has proven that LEADITE not only makes a tight, durable joint,—but that it improves with age.

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 15%

THE LEADITE COMPANY
Girard Trust Co. Bldg. Philadelphia, Pa.

No Caulking